Towards an Integrated NOS Environmental Monitoring Strategy

Report I: Current and Planned NOS Environmental Monitoring Activities

Coastal Environmental Monitoring Committee

June 2000

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Executive Summary

This report characterizes NOS's existing and planned operational monitoring efforts and outlines the steps proposed to develop a more integrated coastal monitoring plan for the National Ocean Service. It has been produced in response to a charge from NOS Administrator, Dr. Nancy Foster, to the Coastal Environmental Monitoring Committee (CEMC) to develop a coastal envrionmental monitoring plan to:

> *"address all activities conducted or supported by NOS related to the regular collection, management, analysis, and dissemination of environmental monitoring and observational data and information. The plan should summarize existing and planned NOS efforts, recommend ways to improve NOS's effectiveness and efficiency of those efforts, and provide estimates of the resources necessary to fully implement NOS's responsibilities in this area."*

Given this charge, the Committee developed a conceptual framework to capture monitoring related activities conducted by NOS:

- Defining Needs and Integrated Planning
- Methods Development and Research
- Data Acquisition
- Data Delivery
- Assessment Products
- Management, Education and Decisionmaking

This report focuses on NOS operational monitoring programs and the resources that support them. It does not examine the scale, scope, focus and investment in monitoring associated with research or experimental monitoring or capture the investments. The report summarizes the Committee's objectives, proposed approach, and schedule; defines coastal monitoring and the elements of an integrated program; discusses why NOS monitors; provides an inventory of NOS programs; and presents an analysis of programs by purpose, focus, cost, and products. This is the first of three reports; subsequent reports will address information needs and data gaps, options for improved integration, and final recommendations.

Inventory and Survey of NOS Monitoring Programs

Using a survey instrument (see Appendix I), the Committee conducted an inventory of existing NOS monitoring programs. The Survey collected information on the major characteristics of NOS monitoring programs, including such components as program office and contact, purposes of monitoring, primary focus, users and customers of data, funding, and spatial and temporal scale.

Results

The initial survey identified a total of 23 NOS monitoring programs and activities:

- 21 are ongoing and generally national in scope
- 1 is suspended due to funding (benthic surveillance)
- 1 (the Marine Sanctuary Program) represents a diverse set of monitoring activities that, at present, are not organized into a formal, national program
- 16 programs are focused on ecosystem monitoring
- 5 programs are focused on physical monitoring
- 2 programs are focused on socioeconomic monitoring

Survey Analysis
The Survey calculates a total NOS investment in monitoring of $30.0 - 30.5 million:

- Approximately $20 million is expended for CO-OPS, NGS, and OCS programs related to "Safe Marine Operations." This illustrates that about two-thirds of NOS funding is spent on collection and dissemination of physical data, consistent with the historical role of the agency to ensure safe navigation.
- About $9.25 million is available for marine ecosystem monitoring, with the majority of that funding spent on data acquisition. This $9.25 million represents approximately 3% of the total NOS budget for FY00. About 62% ($5.75 million) of this amount is spent on repetitive monitoring for living marine resources, habitat, and water quality, representing a relatively small investment for an agency with a coastal stewardship mission.
- NOS spends approximately $0.7 million on socio-economic monitoring to characterize use and value of coastal resources.
- The $30.0 - 30.5 million investment total from the survey represents just under 11% of the total NOS budget of approximately $273 million for FY00 (not including construction funds). This investment total does not include the cost of NOAA ship time to support monitoring which has been estimated to be about $15 million.

Next Steps
The Committee will continue its activities as follows:

- **Gaps Analysis –** will examine gaps and needs for existing programs and longer-term monitoring needs, through a series of issue-specific monitoring roundtable discussions. These roundtables will include an expanded look at other monitoring activities and data sets. This will also tie in other NOAA programs and consider other Federal monitoring frameworks (e.g., CENR, C-GOOS).
- **Options and Costs –** the Committee will develop options and costs for an integrated NOS monitoring program, including feedback from external users.
- **Final Recommendations –** the Committee will develop recommendations that will receive review and guidance by the NOS Senior Management Council. This report will outline a vision for short and long-term monitoring activities and guide FY03 investments.

Introduction

This report characterizes NOS's existing and planned operational monitoring efforts, and outlines the steps proposed to develop a more integrated coastal environmental monitoring plan for the National Ocean Service. It is the first in a series of three reports that will support the development of this plan. The other two reports will address data gaps and information needs and options and costs of an integrated monitoring program, and final recommendations and implementation strategy.

Charge to Committee

At a summer 1999 meeting, the NOAA Science Advisory Board recommended to Dr. D. James Baker, NOAA Administrator, establishing and maintaining a collaborative and coordinated coastal ocean and estuarine monitoring system to measure the physical, biological, and chemical parameters of the marine environment. As a result of that recommendation, as well as independent recognition of the urgency and opportunities for enhanced inter-disciplinary coastal ocean and estuarine observing systems, a committee of senior-level line office representatives was formed to focus NOAA's efforts on coastal and living resource monitoring issues such that comprehensive proposals for FY 2002 and beyond can be developed and supported by several NOAA's strategic planning teams.

The NOS Science Council, recognizing the importance of enhanced monitoring to NOS's mission and programs, and aware of additional emphasis being placed on expanded coastal environmental monitoring systems by the Administration and Congress, recommended to Dr. Nancy Foster, Assistant Administrator for Ocean Services and Coastal Zone Management, that NOS take an active role in developing such a system. Dr. Foster subsequently directed the NOS Senior Scientist to lead the development of an NOS Coastal Environmental Monitoring Plan to:

"address all activities conducted or supported by NOS related to the regular collection, management, analysis, and dissemination of environmental monitoring and observational data and information. The plan should summarize existing and planned NOS efforts, recommend ways to improve NOS's effectiveness and efficiency of those efforts, and provide estimates of the resources necessary to fully implement NOS's responsibilities in this area."

In response to this charge, NOS formed a Coastal Environmental Monitoring Committee (CEMC, hereafter referred to as the "Committee"), which was tasked with developing a plan to address coastal monitoring needs. Once completed, this plan will provide valuable information needed to coordinate NOS monitoring with the broader NOAA monitoring plan development.

Elements of an Integrated Monitoring Strategy

The first step the Committee took in addressing its charge was to determine the scope of its efforts. Should it consider a relatively narrow range of monitoring programs, or initially be inclusive in identifying what kind of monitoring NOS conducts? Should it focus only on data collection activities, or take a more comprehensive view of what constitutes an integrated monitoring program? The Committee decided to be more inclusive rather than restrictive and to take a broad view, because it considers monitoring to be the collection of environmental data, within the context of a set of inter-related activities that provide information for improved decisionmaking.

To this end, the Committee developed a conceptual framework that outlines six major elements of an integrated monitoring strategy (Figure 1). This framework provides a useful way to categorize the types of monitoring activities undertaken

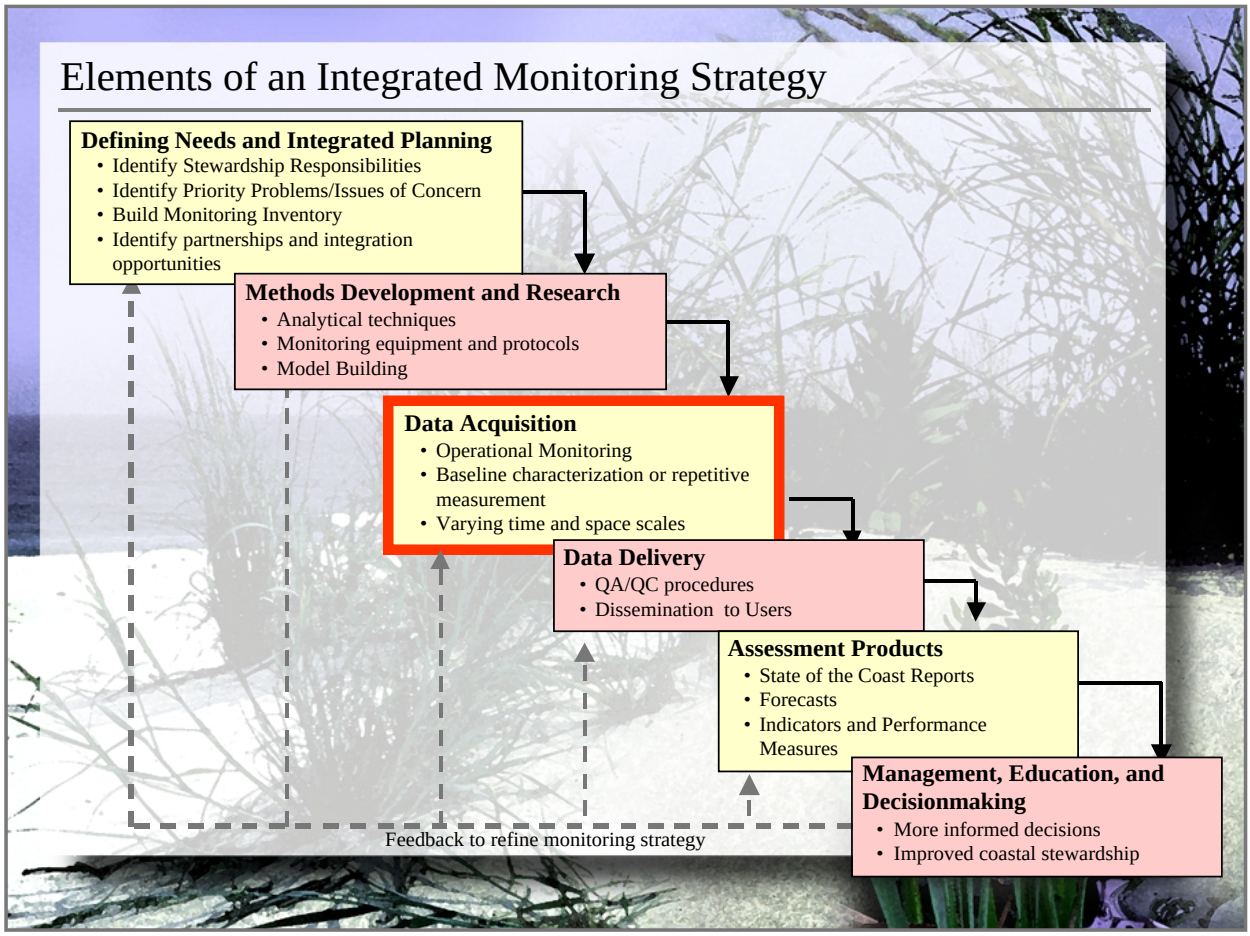


Figure 1. Elements of an Integrated Monitoring Strategy.

by each office and understand the allocation of resources dedicated to each element, both within programs and across NOS.

Definitions

As a next step in determining the scope of the assessment, the Committee agreed on a definition relating to the type, focus, and scale of monitoring.

> **<u>NOS Coastal Environmental Monitoring</u> – consists of all activities conducted or supported by NOS involving the sustained, often repetitive, collection of measurements taken to establish a baseline and /or determine a trend in environmental change, including the management, analysis, and dissemination of these measurements.**

Given this broad definition of monitoring, it is useful to draw a further distinction between two important types of monitoring supported by NOS. Operational monitoring is monitoring conducted as part of an established program to collect and disseminate data and information for clearly defined needs and users. Data collection and analysis protocols are generally standardized, and the program has sustained funding support. Monitoring to support research is generally short-term monitoring conducted over a limited area. It is undertaken to develop, test, or validate data collection techniques and/or analysis protocols, or to support a specific research investigation or issue. Note that this initial inventory of NOS monitoring concentrates only on evaluating <u>operational monitoring</u> programs.

A second useful approach to categorizing NOS monitoring activities is by activity focus, that is, the thematic areas for which monitoring is conducted. The Committee has used categories

adapted from a list of the seven critical areas needed in an integrated U.S. ocean observing system. For this assessment, the category for "ensuring national security" has been dropped because it did not pertain to any NOS monitoring activities, and a new category for "Sustainable Coastal Communities" has been added. This modified list of seven monitoring focus categories (bold text indicates the shorthand version used in tables and graphics in this report) are:

- **Detecting** and Forecasting Oceanic Components of **Climate Variability**
- **Safe Marine Commerce**
- **Managing Living Marine Resources** for Sustainable Use
- Preserving /Restoring **Healthy Marine Ecosystems**
- **Mitigating Natural Hazards**
- **Ensuring Public Health**
- **Sustainable Coastal Communities**

Finally, the Committee felt it was important to capture the spatial scale and function of the NOS programs. To do this, it is using an adapted three-tiered classification scheme recommended in a report produced by the Committee on the Environment and Natural Resources (1997):

Tier I (Characterization of the Problem) – Broad scale ecological characterization. Identifies emerging issues and track status and trends of coastal ecosystems. Typically, synoptic spatial coverage with more limited temporal resolution and/or ecological parameters. Spatially continuous monitoring and inventories, including remote sensing, that completely census specific properties across a large region.

Tier II (Diagnosis of Causes) – Develops cause and effect relationships among environmental stressors and ecological response variables. Higher spatial and temporal resolution, usually focused in regions or on issues identified through Tier I. Provide data and information directly relevant to remedial action plans. Spatially subsampled surveys and monitoring that are designed to evaluate the status of a large region by sampling a subset of the total area.

Tier III (Diagnosis of Interaction and Forecasting) – Spatially and temporally intensive at relatively few locations. Generally involves process research related to ecosystem response to environmental stresses. Intensive research sites that are selected due to their known ecological condition or suitability for experimental manipulation.

A Phased Approach

Given the complexity of the charge, the Committee proposes a set of activities (data collection, assessments and worksessions) that will produce a set of three reports that summarize the current and planned monitoring activities; information needs and data gaps, options for improved integration, and final recommendations. Figure 2 shows the proposed timeline for these reports, and the major associated activities. The key elements of each report are envisioned as follows:

- **Report I** (this report) will summarize the committee's objectives, proposed approach, and schedule; define coastal environmental monitoring and the elements of an integrated monitoring program; briefly discuss why NOS monitors (the legislative basis and roles and responsibilities), provide an initial inventory of existing and planned NOS operational monitoring programs; and present an preliminary analysis of the types of NOS monitoring programs by purpose, focus, cost, products and geographic distribution.

- **Report II** will outline the need for developing an integrated NOS environmental monitoring plan within the context of the evolving Federal/state coastal monitoring framework; describe the short- and long-

term vision for NOS monitoring and monitoring elements relative to NOS program and stewardship objectives, NOAA program and stewardship objectives, and Federal/state coastal monitoring frameworks; and identify the specific NOS data gaps and information needs. In addition, it will present options and costs estimates for an integrated NOS monitoring program. These options will be identified and evaluated in one or more CEMC worksessions to be held in spring and summer 2000. External users of NOS monitoring information will participate in these sessions to provide constituent input.

- **Report III** will present the final recommendations for an integrated NOS environmental Monitoring Plan, based on the review and guidance from the NOS Senior Management Council. The Plan should define the long-term strategy for NOS's coastal monitoring elements, and identify short- and long-term opportunities for NOS to integrate the effectiveness of monitoring and support Federal/state coastal monitoring frameworks. This final report will provide input to NOS/NOAA strategic planning teams to guide FY03 investment proposals.

Proposed Timeline for NOS Integrated Monitoring Plan Development

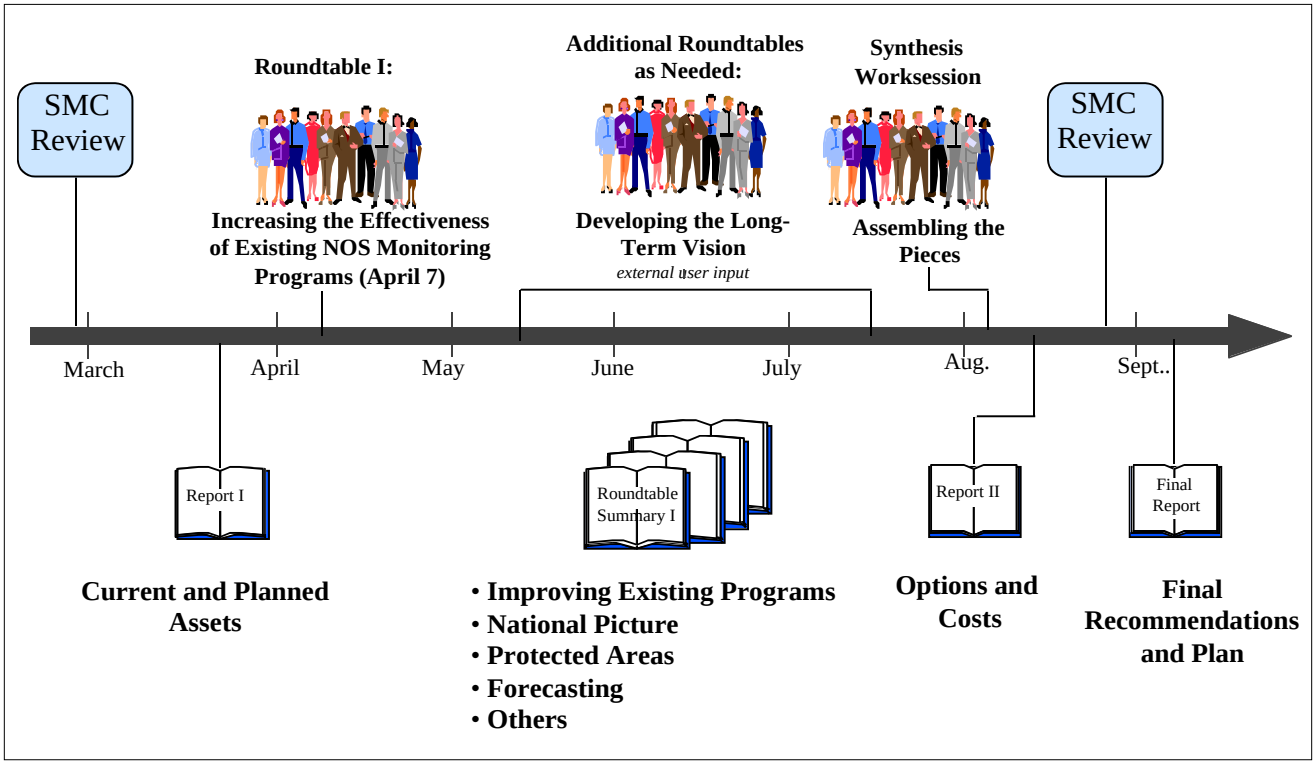


Figure 2. Proposed Timeline for NOS Integrated Monitoring Plan Development.

Why Does NOS Monitor?

As the Nation's principal advocate for coastal stewardship, NOS's mission is to preserve and enhance our coastal resources and ecosystems while supporting economic growth for the long-term benefit of the Nation. To fulfill this responsibility, it must provide the science, information, management, and leadership necessary to balance the environmental and economic well being of the Nation's coastal resources and communities.

NOS's Environmental monitoring activities gather information needed to fulfill its mission. The monitoring programs provide information necessary to increase the quality and timeliness of Federal actions, assist state and local governmental decisions, aid in private-sector development, and enhance the coastal stewardship community's awareness and understanding of the status and health of the nation's coastal resources.

Historical Perspective

To understand what the full range of NOS's monitoring activities may look like in the future, it is instructive to briefly consider the history of NOS's monitoring efforts. The hydrographic surveying, geodesy, and chartmaking functions underlying the "safe marine commerce" focus of NOS monitoring date back to the Survey of the Coast in 1807. Though the scope of activities changed several times over the next 163 years, this core monitoring activity was a well established and long standing responsibility when, in 1970, the U.S. Coast and Geodetic Survey became the National Ocean Survey under the newly established National Oceanic and Atmospheric Administration (NOAA). Since that time, there have been several additional organizational changes and many technological advances, but the scope and purpose of this type of monitoring of physical characteristics of the coast and coastal waters has remained essentially the same.

While there were likely components of ecological and ecosystem monitoring that date to the establishment of NOAA, there are several significant milestones that mark discrete focal points for these efforts. In 1974, the Outer Continental Shelf Environmental Assessment Program (OCSEAP) was established through an interagency agreement between NOAA and Bureau of Land Management. OCSEAP was designed to provide important baseline ecological data for the purpose of evaluating proposed outer continental shelf oil lease sales, focusing on Alaska. Also in 1974, the Model Experimental Systems Analysis (MESA) program was underway, conducting research on the dumping of dredge material and sewage sludge in the coastal waters of the New York Bight. Both of these activities focused on the particular environmental impacts of significant activities conducted within the "blue water" of the United States and both were conducted for a discrete timeframe. As such, neither was designed to monitor the full extent of U.S. coastal waters for the full range of ecological parameters.

A major advance occurred in 1984 with the establishment of the National Status and Trends (NS&T) Program. The NS&T Program was designed to determine the current status of, and detect changes in, the environmental quality of the Nation's estuarine and coastal waters. However, funding limitations for the program have resulted in a more narrow focus on toxic contaminants. Since 1986, NS&T's Mussel Watch Program has monitored chemical contaminants in sediments and bivalve mollusks (e.g., mussels and oysters). Additional ecological monitoring efforts within NOS have been initiated through the National Estuarine Research Reserve System-wide Monitoring Program, established in 1995, and specific activities of the National Marine Sanctuary Program (e.g., the Florida Keys Water Quality Protection Program, established in 1994). The formation of the Coastal

Services Center in 1994 created a new advocate for using innovative technologies to provide coastal resource information to state and local constituents.

Basis for NOS Monitoring - *NOS programs draw their justification to conduct monitoring and assessment activities from a variety of sources, including legislative mandates, authorizations, administrative actions, and agency strategic planning.*

The NOS Strategic Plan includes several directives on monitoring:

Vision - Individuals and institutions have the tools and information necessary to preserve, protect, and develop the environmental well-being and economic prosperity of the Nation's coastal and ocean resources for this and future generations.

Mission - To be the Nation's principal advocate for coastal stewardship through partnerships at all levels. To support and provide the science, information, management, and leadership necessary to balance the environmental and economic well-being of the Nation's coastal resources and communities.

Coastal and Great Lakes Science - NOS will implement strong, integrated coastal research, monitoring and assessment programs focused on the cumulative effects of human activities and supported by a cadre of scientific experts. This will increase the relevance and credibility of NOS's coastal stewardship mission, as well as promote the needs of its user community by making coastal science more accessible to decisionmakers at all levels.

Core Products and Services - *Research, Assessments, and Monitoring* lie on the continuum along which scientific information is developed and transferred to resource users, managers, regulators, and the scientific community. These activities lead to a wide array of products and services including reports, news articles, data bases, maps and charts, consulting expertise, and Internet-accessible information.

In addition, Program Office strategic plan objectives outline a number of activities related to monitoring. Below is a sample of these objectives:

NCCOS - Provide the means to detect, monitor, and predict the effects of multiple anthropogenic and natural perturbations on coastal ecosystems.

OCRM - Enhance information, technology, and tools for coastal stewardship; e.g., expand the use of technology for coastal and ocean management; increase the availability of resource inventory and national trend information; enhance the ability to measure changes and knowledge about necessary actions; increase economic valuation information for decision-making.

CSC - In the near-term, CSC seeks to develop…methodologies and physical capacities to assess and test technologies and sensors for environmental monitoring, response and remediation.

OR&R - Conduct research and monitoring projects to investigate the physical, biological, and chemical processes relevant to coastal pollution, and the environmental consequences of mitigation techniques, spill countermeasures, and remedial and restoration activities at spills and waste sites.

OCS - Develop and maintain a comprehensive database of marine geographic information that supports multiple products on demand.

CO-OPS - Monitor and assess sea level response to seasonal and long-term climate change in U.S. coastal regions.

Mandates and Authorities

There are four main laws which provide the mandates for most of NOS' monitoring programs. In the survey on NOS monitoring programs, offices were able to select from a list of mandates or provide their own options. A total of twelve laws or executive orders were identified by NOS offices. Appendix II presents the specific language in each law relevant to monitoring or assessment authorities.

Marine Protection, Research, and Sanctuaries Act (MPRSA) - This act has three major components:

- *Ocean Dumping Act (also known as Titles I and II of MPRSA).* This Act prohibits transporting any material from the U.S. for the purpose of dumping it into ocean waters, or dumping any material into ocean waters, except as authorized by permit.

- *National Marine Sanctuaries Act (also known as Title III of MPRSA).* This Act authorizes the Secretary of Commerce to designate discrete areas of the marine environment as National Marine Sanctuaries to protect distinctive natural and cultural resources whose protection and beneficial use requires comprehensive planning and management.

- *National Coastal Monitoring Act (also known as Title V of MPRSA).* This Act establishes the Comprehensive Coastal Water Quality Monitoring Program, to be administered by the Administrator of the Environmental Protection Agency and the Under Secretary of Commerce for Oceans and Atmosphere. The primary purpose of the program is to identify and analyze the environmental quality of the nation's coastal ecosystems. Title V was added in 1992, but no funds have ever been appropriated to implement the Act's provisions and authorization expired in 1996.

However the Survey on NOS Monitoring Programs did not inquire specifically which section applies to which office of NOS. Therefore, most offices did not identify which specific Title applied to their monitoring program (see list below).

The following monitoring programs derive authority from the MPRSA:

- NS&T Mussel Watch
- NS&T Bioeffects Survey
- NS&T Benthic Surveillance
- Coastal Intensive Site Network
- National Marine Sanctuary Monitoring
- Land Cover Change Analysis
- Benthic Habitat Assessment and Mapping
- Prince William Sound Long-term Monitoring Program
- Socioeconomic Monitoring for Florida Keys National Marine Sanctuary
- National Survey on Recreation and the Environment

Coastal Zone Management Act - The Coastal Zone Management Act was enacted to encourage the participation and cooperation of state, local, regional, and federal agencies and governments having programs affecting the coastal zone.

The following monitoring programs derive authority from this Act:

- Florida Keys NMS Zone Monitoring
- South Florida Benthic Community Monitoring
- Harmful Algal Bloom Monitoring
- National Marine Sanctuaries Monitoring
- National Estuarine Research Reserve System-wide Monitoring Program
- Land Cover Change Analysis
- Benthic Habitat Assessment and Mapping
- National Survey on Recreation and the Environment

Clean Water Act - The Clean Water Act created a system of regulating discharges and spills of pollutants into surface waters (rivers, streams, lakes, etc.). It specifically directs NOAA to conduct a comprehensive national survey of data regarding aquatic sediment quality in the U.S.

The following monitoring programs derive authority from this Act:

- National Marine Sancutaries Monitoring
- Land Cover Change Analysis
- Benthic Habitat Assessment Assessment and Mapping
- Prince William Sound Long-term Monitoring Program
- National Survey on Recreation and the Environment

Coastal And Geodetic Survey Act - This Act directs NOAA to provide charts and related information for the safe navigation of marine and air commerce, and to provide basic data for engineering and scientific purposes and for other commercial and industrial needs

The following monitoring programs derive authority from this Act:

- Hydrographic Surveying
- Physical Oceanographic Real-Time System
- National Water Level Observation Network
- Geodesy
- Coastal Mapping Program

An Inventory of NOS Monitoring Programs

The Committee completed an inventory of NOS monitoring programs as a starting point for characterizing the type and extent of activities currently supported by NOS to measure coastal environmental parameters and conditions. This initial inventory was directed at only one of the "monitoring elements" outlined in this report, focusing solely on data acquisition. As such, the inventory does not include information on a variety of other NOS program activities related to monitoring, such as methods development and research, data delivery, and assessments of monitoring information. Even so, nearly two dozen monitoring programs associated with data acquisition are currently underway, spanning an enormous range of scales, parameters, and purposes.

Recognizing the broad range of information that could potentially be included in a monitoring inventory and the need for accurate and consistent characterizations, the Committee developed a survey instrument (see Appendix I) for collecting information on NOS programs, providing pre-defined response alternatives. The survey was then completed by each of the Committee members (as representatives of the NOS program offices) to describe both existing, on-going monitoring programs and planned activities. Existing monitoring programs included those that are: 1) supported solely through NOS funds; 2) supported through NOS partnerships; and 3) currently suspended due to resource constraints. Planned monitoring programs included those activities for which NOS funds have been identified in the fiscal year 2000 budget. An addendum to the survey was utilized to gather additional detail on NOS investments in monitoring and the products developed from those investments.

The Survey of NOS Monitoring Programs (Appendix I) collected information on the major characteristics of NOS environmental monitoring activities. Survey components included the following:

- NOS program office and contact
- Purpose of the monitoring activity
- Legislative mandates/authorizations for monitoring
- Primary focus of the monitoring activity
- Parameters for which monitoring data is collected
- Temporal characteristics of monitoring
- Users/Customers for monitoring activity/ data
- Annual funding
- Availability of data (access)
- Monitoring Tier (spatial and temporal scale)

Table 1 provides a list of NOS monitoring programs and activities, including a brief description of each. Individual survey responses are available via the CEMC's internal, working Web site:

http://is2.nos.noaa.gov/monitoring/cemc/

Table 2 summarizes several significant features of NOS monitoring programs, including the focus of the monitoring effort, the scale of the activity, and an estimate of the annual NOS investment in the activity.

Table 1. Summary Descriptions of NOS Operational Monitoring Programs.

Program Name	Description
National Centers for Coastal Ocean Science (NCCOS)	
National Status and Trends (NS&T) Mussel Watch	Determines concentrations of polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyl (PCB) congeners, several pesticides, butyltins, and certain toxic elements in sediment and bivalve samples from the coastal waters of the US in sediments and bivalve mollusks (e.g., mussels and oysters). Presently, bivalve data are collected every other year and sediment data about every fifth year at a network of over 250 U.S. coastal and estuarine sites around the nation. Sites are selected to be representative of large coastal areas and to avoid small-scale patches of contamination, or "hot spots." Data can be used to compare contaminant concentrations across space and time to determine which coastal regions are at greatest risk in terms of environmental quality. Bivalve and sediment samples are collected from three stations at each site.
NS&T Bioeffects Survey	Studies to determine the incidence, severity, and spatial extent of biological effects of contamination in coastal waters. Studies consist of sediment toxicity surveys, evaluation and application of biomarkers, development of effect-based numerical guidelines to infer toxicological relevance of sediment contamination, and formulation of indices to describe the condition of the coastal ecosystems. Sediment toxicity surveys are conducted in specific coastal regions where contaminant monitoring data from the NS&T Program and other information from state and local sources, indicate that the potential for substantial environmental degradation and associated likelihood of biological effects exists. Studies are performed over a two-to-four year period. Sediment toxicity assessments are based on bioassays, impaired fertilization and larval development assessments, and measures of physiological stress. Biomarkers are being developed or tested to validate their field performance using endemic or transplanted bivalves or demersal fish.
NS&T Benthic Surveillance	This program monitored chemical concentrations of over 70 organic and inorganic contaminants in the liver and metabolites of PAH's in the bile of bottom dwelling fishes and associated surficial sediment from coastal and estuarine waters of the Atlantic, Gulf of Mexico, and Pacific coasts, including Alaska from 1984 through 1993. Program was initiated to determine the current status of and to detect any long-term trends in the environmental quality of the nearshore waters of the United States. Contaminant exposure and bioeffects were monitored at more than 170 sites nationwide. Incidences of visible lesions were noted and histopathological examinations of selected liver, kidneys, fins, gills, ovaries, and testes were conducted. Expanded in 1987 to include measurements of biological effects due to contaminant exposure.
Coastal Intensive Site Network	This is an EPA/NASA/NOAA partnership to develop an intensive coastal site network of monitoring and research locations throughout the United States. Involves intensive, long-term monitoring and research sites at 14 sites around the U.S. marine and Great Lakes coasts. CISNet has three objectives: (1) To develop a sound scientific basis for understanding ecological responses to anthropogenic stresses in coastal environments, including the interaction of exposure, environment/climate, and biological/ecological factors in the response, and the spatial and temporal nature of these interactions. (2) To demonstrate the usefulness of a set of intensively monitored sites for examining short-term variability in long-term trend behavior in the relationships between changes in environmental stressors, including anthropogenic and natural stresses, and ecological response. (3) To provide intensively monitored sites for development and evaluation of indicators of change in coastal systems.
Coral Reef Mapping	In partnership with DOI, NOS is beginning an effort to begin mapping U.S. coral reefs, starting in the Virgin Islands, Puerto Rico and Hawaii. Aerial photographs of the nearshore waters and used to create maps of the region's marine resources including coral reefs, seagrass beds, mangrove forests, and other important habitats for fisheries, tourism, and other aspects of the coastal economy. Benthic habitat maps will be produced directly in a GIS using visual interpretation of scanned aerial photographs, and a classification manual will be produced to document the specific methods used in image interpretation and habitat classification.
Coral Reef Monitoring	Proposed. Monitoring to begin in September 2000, based on outcomes of design process with coral reef managers and scientists. The objective is to establish a nationally coordinated, long-term monitoring program for US coral reefs, consisting of new efforts linked strategically to ongoing monitoring programs worldwide. Initial monitoring will focus on priority habitat issues for reefs of particularly high value (e.g., Marine Protected Areas) or at high risk of degradation.
Florida Keys NMS Zone Monitoring	A zone monitoring program was initiated in 1997 to determine the effectiveness of 'no-take' zones in protecting biodiversity. The program monitors three types of no-take zones: eighteen small sanctuary preservation areas, four special use areas and an ecological reserve. The sanctuary also initiated a five-year zone monitoring program looking at changes in ecosystem function and populations of key species. The goal is to determine by the year 2002 whether the zones are effective in protecting marine biodiversityand enhancing human values related to the Sanctuary. Measures of effectiveness will include the abundance and size of fish, invertebrates, and algae; and economic and aesthetic values of Sanctuary users and their compliance with regulations. Key species (e.g. spiny lobster, coral, queen conch, fish, urchins), sea grass, and water quality are monitored.
South Florida Benthic Community Monitoring	The invertebrate benthic community of Florida Bay, the Florida Keys National Sanctuary, and adjacent waters is being monitored by collecting samples at several hundred sites on a periodic basis and by identifying and counting the species found in these samples. The data are providing sensitive indicators for determining the status and trends of the benthic community.
Harmful Algal Bloom Monitoring	Studies are being carried out at several sites in Maryland and Florida where blooms of Pfiesteria or Pfiesteria-like dinoflagellates have occurred in the recent past. Intensive short time-scale monitoring of a number of physical, chemical, and biological properties is being conducted. At two sites continuous monitoring systems have been established on buoy systems. These projects will obtain data used for characterizing and establishing causative relations related to blooms of certain harmful algal bloom organisms and for testing and evaluating improved monitoring methods.
Gulf of Mexico Hypoxia Hydrographic and Biological Surveys	Monitors the distribution and dynamics of low dissolved oxygen and algal blooms off the Louisiana continental shelf through a mid-summer intensive study plus monthly transects between Terrebonne Bay and 100 foot water depth on shelf. Includes: 1) monthly hydrographic cruises off Terebonne Bay on the southeastern Louisiana continental shelf; 2) a shelf-wide hydrographic survey from the Mississippi River delta to the Texas/Louisiana border in July; and 3) deployment of instruments on a mooring in 20-m water depth off Terrebonne Bay. Routine analyses include: hydrographic CTD casts (includes DO); additional bottom water measurements of temperature, salinity and DO with ROV; surface, bottom, and some mid-depth water Niskin bottle samples; salinity; chlorophyll a and phaeopigmrent biomass; nutrients; light profiles; underway flow-through measurements of temperature, salinity, oxygen; current measurements (ADCP). The bottom instrument mooring includes current, CTD, pressure, and oxygen meters.

Table 1. Summary Descriptions of NOS Operational Monitoring Programs, continued.

Program Name	Description
Office of Ocean and Coastal Resource Management (OCRM)	
National Marine Sanctuaries Monitoring	Monitoring activities vary considerably from sanctuary to sanctuary, but data are collected through or in collaboration with a variety of partner agencies, organizations, universities, and volunteers. Data focus is primarily on water quality, fish, marine mammals, seabirds, and habitat.
National Estuarine Research Reserve System-wide Monitoring Program	The SWMP program includes data collection from each of the NERR sites (25 currently exist, 2 more underway in FY2000/1). It monitors physical and chemical parameters to assess water quality and the impacts of weather. Subsequent activities will include mapping habitat change, monitoring environmental stresses and assessing watershed land-use changes. The goal for the System-wide Monitoring Program is "to identify and track short-term variability and long-term changes in the integrity and biodiversity of representative estuarine ecosystems and coastal watersheds for the purposes of contributing to effective national, regional, and site specific coastal zone management". This program consists of three phased components: (1) abiotic factors (i.e. water quality & meteorological monitoring); (2) biodiversity monitoring, and (3) land use planning analysis. Some of the information gathered includes: salinity, DO, depth, temperature and pH.
Coastal Services Center (CSC)	
Land Cover Change Analysis	C-CAP, in cooperation with partners, uses remote sensing (Thematic Mapper satellite) to classify land cover in coastal upland and wetland habitats of the United States, including the Atlantic, Pacific, Gulf of Mexico, the Great Lakes, Alaska, Hawaii, and all U.S. territories and possessions. Subsequent classifications are used to document changes in these resource areas and help coastal managers understand the consequences of changes.
Topographic Beach Change Mapping	LIDAR is used to collect high-resolution topographic and other spatial data sets in response to the need for accurate, timely information on beach and dune field topography for the Pacific, Great Lakes, East Coast and Gulf Coast regions (in partnership with USGS and NASA). Products are used in coastal zone decision making processes.
Benthic Habitat Assessment and Mapping	Benthic habitats, including seagrasses (much of U.S. coasts), coral reefs (St. Croix and Hawaii) and unstructured sediments (e.g. sand and mud) (Appalachicola and Hudson NERRs) are mapped using a variety of techniques including satellite and airborne sensors, acoustic imaging, videography, photography, and benthic community analysis. These habitat maps establish baseline distributions and are used to assess change over time.
Office of Response and Restoration (OR&R)	
Prince William Sound Long-term Monitoring Program *(sponsored by the Exxon Valdez Oil Spill Trustee Council, conducted by NOS)*	Since 1989, selected intertidal sites have been monitored yearly to determine the extent to which PWS has "recovered" from the Exxon Valdez oil spill and subsequent response operations. Three types of study sites, "oiled with mechanical cleaning," "oiled without mechanical cleaning," and "not oiled," are compared. At each type of site, biological, chemical, and geomorphological monitoring information is integrated to capture a more complete picture.
Office of Coast Survey (OCS)	
Hydrographic Surveying	Hydrographic Surveying focuses on the measurement and definition of the configuration of the bottoms and adjacent land areas of water bodies. The primary use of hydrographic surveys is for nautical charting, including the precise location of aids to navigation, dangers to navigation and, for inshore areas, the delineation of the shoreline and tide or water level measurements.
Centers for Operational Oceanographic Products and Services (CO-OPS)	
Physical Oceanographic Real-Time System	PORTS provides ship masters and pilots with accurate real-time information required to avoid groundings and collisions, including real-time water levels, currents, and other oceanographic and meteorological data from bays and harbors. If FY2001 NOAA budget levels are approved, PORTS will expand to additional estuaries.
National Water Level Observation Network **• Long-term Water Level Measurement Stations** **• Historical Water Level Stations**	NWLON consists of 189 water level measurement stations distributed along U.S. coasts, in the Great Lakes and connecting channels, and in the U.S. territories and possessions. CO-OPS collects, processes and analyzes the water level and ancillary data (Meteorological/Oceanographic Data, Meteorological and Ocean Data for unlisted stations) from NWLON, producing standard time series and water level datum products. Time series data and water level datum products are also available from several thousand historical stations that were established for short time periods (several days to a few years).
National Geodetic Survey (NGS)	
Geodesy	NGS coordinates a network of continuously operating reference stations (CORS) that provide Global Positioning System (GPS) carrier phase and code range measurements in support of 3-dimensional positioning activities throughout the United States and its territories. NGS also monitors subsidence and ocean-loading deformation networks to gauge the effect of geophysical processes on the National Spatial Reference System (NSRS).
Coastal Mapping Program	The goal of the coastal mapping program is to survey the approximately 95,000 miles of coastline in the US and to provide the Nation with an accurate, consistent, up-to-date national shoreline. The method used today to delineate the shoreline is stereo-photogrammetry using tide-coordinated aerial photography controlled by kinematic Global Positioning System (GPS) techniques. This process produces a seamless, digital database of the national shoreline and a database of aerial photography.
Special Projects Office (SPO)	
Socioeconomic Monitoring for Florida Keys NMS	Socioeconomic monitoring in the Florida Keys is designed to provide information on the socioeconomic implications of the implementation of the Sanctuary management plan, including changes in Sanctuary resource utilization patterns and their impact on market and non market economic values of Sanctuary resources.
National Survey on Recreation and the Environment	NOAA's involvement in the NSRE 2000 will allow for comprehensive assessment of the Nation's use of coastal and marine resources for outdoor recreation. The NSRE will establish benchmark data to help policy makers and decision-makers understand recreational use and public attitudes towards natural resources and resource management. This survey will monitor information on 19 water-based activities in coastal/ocean areas, the number of people participating, and how many days they do the activity in each coastal state, and will take place every 5 years.

NOS Operational Monitoring Programs

	NOS Office	Type	Program	Monitoring Focus (Adapted from US GOOS Framework)							Scale			FY00 NOS Total Investment (in $ millions)
				Detecting Climate Variability	Safe Marine Operations	Managing Living Marine Resources	Healthy Marine Ecosystems	Mitigating Natural Hazards	Ensuring Public Health	Sustainable Coastal Communities	Tier I	Tier II	Tier III	
Ecosystem	NCCOS	R	NS&T Mussel Watch				●		o		●			$0.5 - 1.0
		B	NS&T Bioeffects Survey				●					●	●	$0.5 - 1.0
		R	NS&T Benthic Surveillance*				●				●			$0 ($0.5 - 1.0 in 1993)
		R	Coastal Intensive Site Network				●						●	$0.25 -0.5
		B	Coral Reef Mapping			●	●				●			$1.0 - 1.5
		B	Coral Reef Monitoring**, †			●	●				●			$0.25 - 0.5
		R	Florida Keys NMS - Zone Monitoring†			●	●			o			●	$0.75
		R	South Florida Benthic Community Monitoring			●	●						●	$0.1 - 0.25
		R	Harmful Algal Bloom Monitoring†				●		o			●	●	$1.5 - 2.0
		R	Gulf of Mexico Hypoxia Hydrographic and Biological Surveys				●					●		$0.35
														Subtotal: $6.27 - 6.77
	OCRM	B	National Marine Sanctuaries Monitoring			●	●	o				●	●	0.71
		R	National Estuarine Research Reserve System-wide Monitoring Program			o	●					●	●	$1.32
														Subtotal: $1.78 - 2.28
	CSC	B	Land Cover Change Analysis			●	o			o	●			$0.45
		B	Topographic Beach Change Mapping					●		o	●			$0.20
		B	Benthic Habitat Assessment and Mapping			●	●				●			$0.39
														Subtotal: $0.79 - 1.23
	ORR	R	Prince William Sound Long-term Monitoring Program***				●					●		***Subtotal: $0.05 - 0.55***
Physical	OCS	R	Hydrographic Surveying		●						●			***Subtotal: $7.05 - 7.55***
	CO-OPS	R	Physical Oceanographic Real-Time System		●		o	o			●			$1.00
		R, B	National Water Level Observation Network: • Long-term Water Level Measurement Stations • Historical Water Level Stations	o	●		o	●			●			$8.40
														Subtotal: $9.15 - 9.65
	NGS	R, B	Geodesy		●			o			●			$1.10
		B	Coastal Mapping Program		●			o			●			$2.00
														Subtotal: $2.85 - 3.35
Econ	SPO	R	Socioeconomic Monitoring for Florida Keys NMS							●		●		$0.18
		R	National Survey on Recreation and the Environment							●	●			$0.50
														Subtotal: $0.43 - 0.93
														Total: $30.0 - 30.5

* Currently suspended due to funding constraints, ** Currently under development, *** Sponsored by the Exxon Valdez Oil Spill Trustee Council, conducted by NOS; †Sponsored by NOS, conducted by partner;
R = Repetitive Monitoring, B = Baseline Monitoring; ● = Primary Focus, o = Secondary Focus
Note: Offices provided estimates of total investment as either actual values or ranges as reflected in the table.

Note: The above subtotals represent the sum of actual values or midpoints of ranges where provided. The value is then expressed as a range around this midpoint.

Table 2. NOS Operational Monitoring Programs.

Monitoring in the National Marine Sanctuaries – A "Special Case"

The Survey of NOS Monitoring Programs was completed by each of the 12 National Marine Sanctuaries. As such, each sanctuary was treated as a separate entity, rather than part of a unified, programmatic monitoring effort. Survey results, illustrated in Table 3, show that there are a variety of parameters monitored in the sanctuaries, with considerable variability in the number of parameters measured at each site. There is also considerable variability in the spatial and temporal extent of data collection efforts.

The differences in monitoring efforts between marine sanctuaries is understandable, given their differences in geographic and spatial extent and the different purposes for which they were established. For example, the marine zoning and multiple use management activities in the Florida Keys require extensive monitoring activities to support decision making and evaluation. The historical preservation focus of the Monitor Marine Sanctuary requires little in the way of routine, operational monitoring for environmental conditions.

	Monitoring Focus/Parameters														
Sanctuary	Seabirds	Invertebrates	Reptiles/Amphibians	Marine Mammals	Fishes	Habitat/Vegetation	Meteorology	Geology/Sediments	Hydrology	Physical Oceanography	Water Quality	Air Quality	SocioEconomics	Pollution Sources	**TOTAL**
Channel Islands	■	■		■	■	■				■	■				**7**
Cordell Bank	■	■		■	■										**4**
Fagatele Bay		■			■						■				**3**
Florida Keys	■	■		■	■	■			■	■	■		■	■	**10**
Flower Gardens		■			■						■				**3**
Grays Reef		■	■	■	■					■	■				**6**
Gulf of Farallones	■			■		■					■				**4**
Hawaiian Islands		■	■	■		■					■				**5**
Monitor															**0**
Monterey Bay	■	■	■	■	■	■				■	■			■	**9**
Olympic Coast	■	■		■	■	■		■		■	■				**8**
Stellwagen Bank	■	■		■	■	■		■							**6**
TOTAL	**7**	**10**	**3**	**9**	**9**	**7**	**0**	**2**	**1**	**5**	**9**	**0**	**1**	**2**	

The shaded box indicates that monitoring is present. However, the intensity of the effort (e.g. spatial and temporal extent, number of parameters, etc.) vary significantly among sanctuaries within a given category. Note that the original survey did not include bathymetry as one of the selections for monitoring focus. Follow-up communication with Sanctuary staff indicate that bathymetry measurements are collected as part of the monitoring activities in the Flower Gardens, Hawaiian Islands, Monterey Bay, Channel Islands, and Grays Reef National Marine Sanctuaries.

Table 3. National Marine Sanctuaries Individual Program Monitoring Focus and Parameters.

Survey Results

Below are a set of analyses based on the Survey of NOS Monitoring Programs that illustrate similarities and differences between and among NOS monitoring activities. These analyses provide several synthesis of information from the survey and are provided as examples of different ways of comparing information. Specifically, there are comparisons and contrasts of the purpose, focus, and amount of funding dedicated to NOS monitoring programs. Overall, the survey results show that NOS conducts a wide range of monitoring for a variety of purposes. It is clear that there are gaps both in spatial coverage and monitoring focus that can be addressed through the work of the CEMC.

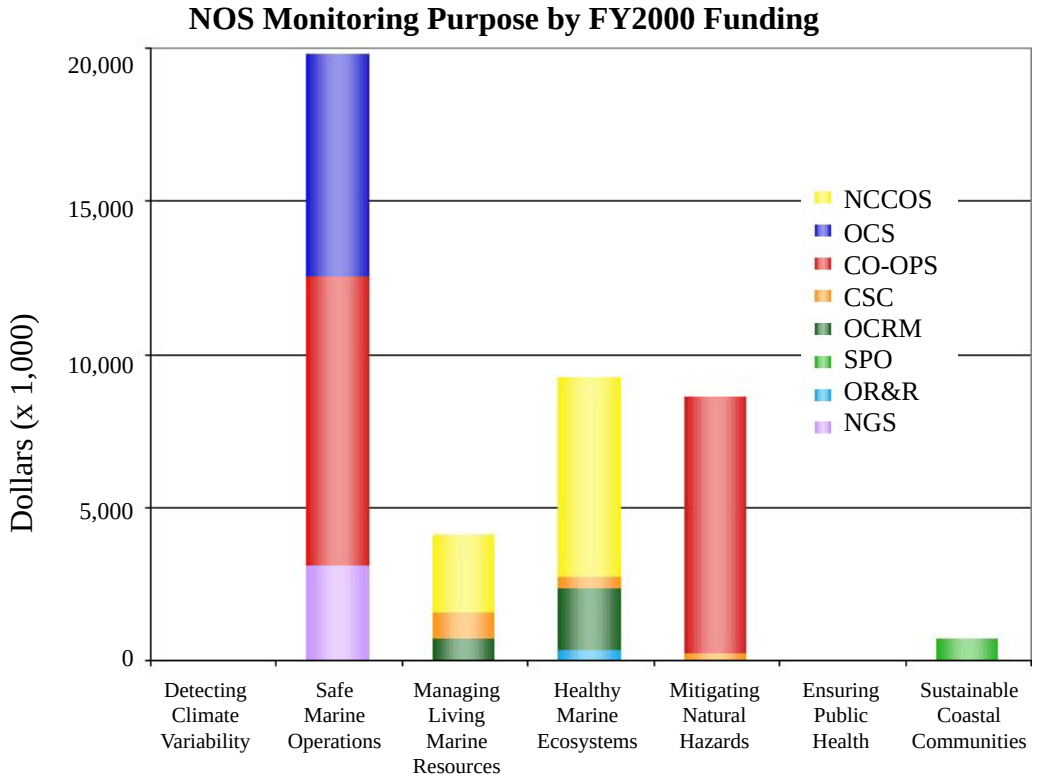


Figure 3. NOS Monitoring Purpose by FY2000 Funding. This graph illustrates the purpose of NOS monitoring programs as a function of the dollars allocated by NOS program offices for these activities[1]. Based on resources allocated for a particular purpose, "Safe Marine Operations" receives the greatest level of funding among NOS monitoring activities, with approximately $20 million allocated to CO-OPS, NGS, and OCS for their responsibilities to ensure safe navigation and accurate positioning. "Mitigating Natural Hazards" receives the second highest level of funding, with approximately $8.6 million going to CO-OPS and CSC for activities such as shoreline mapping and water level information. The graph also illustrates that NOS monitoring investments range across five separate areas and include eight NOS program offices, representing a wide variety of purposes.*

[1] This graph was generated from information taken from Table 2, NOS Operational Monitoring Programs. It is based on certain decision rules used to translate that information: For programs that included a primary and secondary focus, the NOS Total Investment was allocated only to the primary purpose. Where there was more than one primary purpose for the same program, the NOS Total Investment was allocated twice (double counted) – once for each purpose. This leads to high funding levels for both the Safe Marine Operations and Mitigating Natural Hazards purposes. The Detecting Climate Variability and Ensuring Public Health purposes are retained for illustration in the graph, but show no dollars since they were identified only as a secondary focus for the associated NOS Program. Note: the dollar amounts shown are based on midpoints which were derived from funding range responses in the NOS Monitoring Survey Addendum.
* Monitoring for "Healthy Marine Ecosystems" receives the second highest level of funding, with approximately $9.2 million spent on 14 programs.

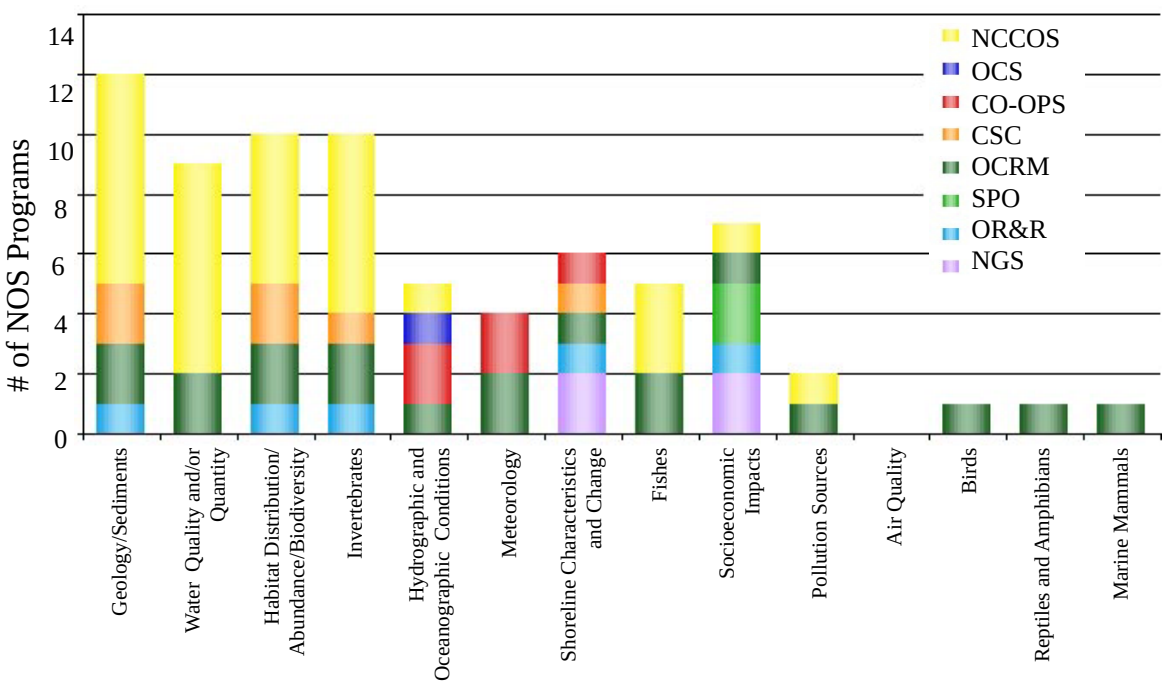


Figure 4. NOS Monitoring Focus. Based on results of the Survey, each of the NOS monitoring programs was evaluated for subject area of focus, including physical environmental data, atmospheric conditions, and information on living resources. This graph illustrates that there are a wide variety of focus areas for NOS monitoring. Some of these focus areas include parameters not traditionally considered in the domain of NOS, such as birds, reptiles and amphibians, and marine mammals. Such focus comes from data collected in the National Marine Sanctuaries on living resources within the sanctuary, though (as described elsewhere in this report) there is considerable variability between sanctuaries in the type of data collected. The greatest number of NOS programs are focused in the area of "Geology/Sediments," primarily as a function of the National Status and Trends program and research activities of NCCOS focused on sediment quality.

Monitoring Funding

Based on the survey results (see *Table 2. NOS Operational Monitoring Programs*), NOS spends approximately $30 million on operational monitoring activities. Of this total amount, approximately $20 million is directed to CO-OPS, NGS, and OCS for their programs, leaving about $10 million for the all of the remaining NOS programs. Given that the majority of CO-OPS, NGS, and OCS monitoring is focused on the collection of physical environmental data, NOS invests 33% of its monitoring resources for collecting ecosystem and socioeconomic data. Of these $10 million in funds, the majority (approximately $5 million) is used for data acquisition. Most of that data is focused on shorelines and sediment in the benthic environment, illustrating that there is currently a relatively small investment in monitoring for living marine resources, habitat and water quality. This investment total does not include the cost of NOAA ship time to support monitoring which has been estimated to be about $15 million.

Placing the current funding for NOS monitoring programs in the larger context, the total budget for NOS in fiscal year 2000 is approximately $273 million without construction funds. Based on the information from the monitoring survey, the total of $30 million currently dedicated for monitoring represents just under 5% of the NOS budget. The $10 million available for NOS programs for ecosystem and socioeconomic data collection represents approximately 4% of the total NOS budget. If NOS is to play a strong and significant role in coastal environmental moni-

toring, there will need to be further consideration given to the overall budget for monitoring and the purposes for which such monitoring is conducted.

These two graphs illustrate differences in NOS monitoring programs in terms of funding – one to illustrate funding by type of program and one to illustrate funding by NOS program office.

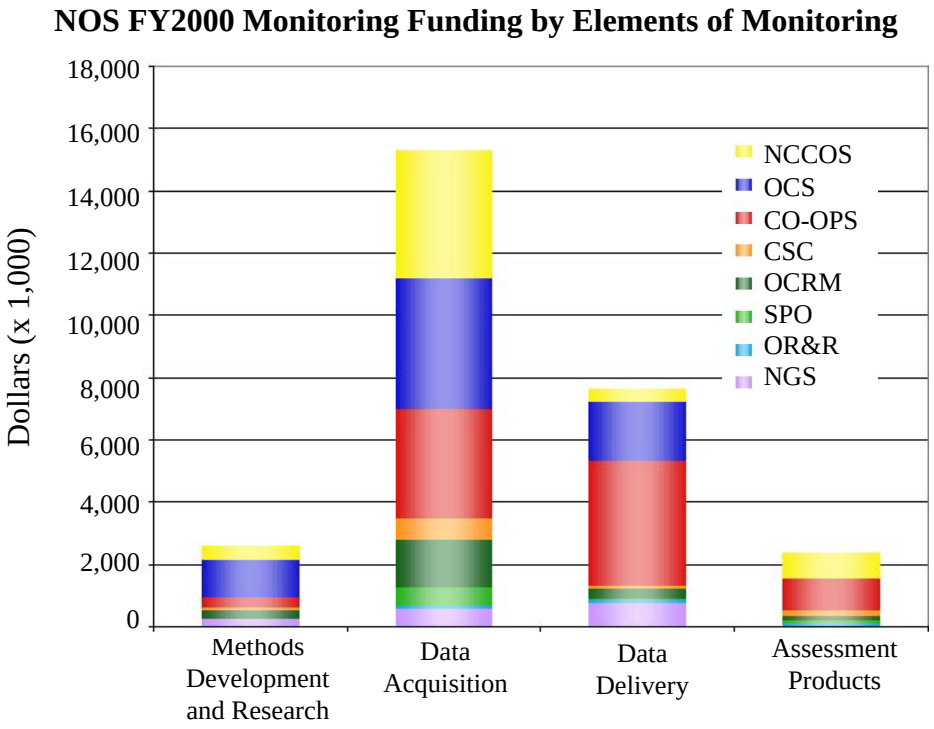


Figure 5. NOS FY2000 Monitoring Funding by Elements of Monitoring. *The majority of NOS resources are dedicated for data acquisition and data delivery and these are a primary function of CO-OPS. There is a relatively small investment in methods development and research from a broad cross section of offices.*
Note: the dollar amounts shown are based on midpoints which were derived from funding range responses in the NOS Monitoring Survey Addendum. Note also that in some cases totals from figures 5 and 6 will not match totals in Table 2 because the amounts reported by offices for different elements of monitoring (methods development and research, data acquisition, etc.) did not sum to the totals provided for the entire monitoring program.

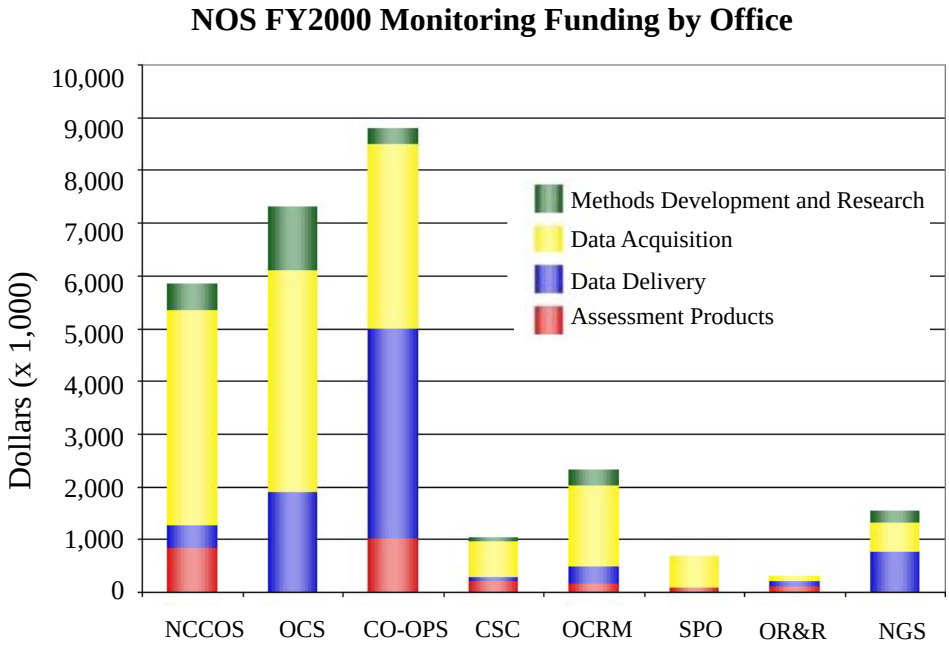


Figure 6. NOS FY2000 Monitoring Funding by Office. *CO-OPS has the largest budget for monitoring, with a fairly even split between data acquisition and data delivery. The majority of the funding for other office's funding is for data acquisition, with NGS having a greater focus on data delivery.*
Note: the dollar amounts shown are based on midpoints which were derived from funding range responses in the NOS Monitoring Survey Addendum.

NOS Monitoring Products

The Survey also gathered information on the type of data dissemination tools used by NOS to distribute monitoring data products. The results show that offices use a variety of approaches to delivery information to users, thought there does not appear to be uniformity in how data are used or synthesized across program offices.

It is interesting to note that, looking across line office, web sites are the most frequently cited tool used to deliver monitoring products, followed by reports and use of digital data sets. This suggests that NOS offices have been proactive in taking advantage of the potential of the Internet to reach and serve a large number of users.

	NCCOS	OCS	CO-OPS	CSC	OCRM	SPO	OR&R	NGS
Raw Data								
Digital Data Sets	●		●	●	●	●		●
CD-ROM	●				●	●		●
Web Site	●		●	●	●	●	●	●
Report				●	●		●	
Article					●		●	
Conference Presentation					●		●	
Processed Information								
Digital Data Sets	●	●	●	●	●			●
CD-ROM	●	●	●	●	●			●
Web Site	●		●	●	●	●	●	●
Report	●		●		●	●	●	●
Article	●		●		●		●	
Conference Presentation	●		●		●	●	●	
Synthesis Product								
Digital Data Sets	●		●		●			
CD-ROM	●		●	●	●			
Web Site	●		●	●	●		●	
Report	●	●	●	●	●	●	●	
Article	●		●	●	●		●	
Conference Presentation	●		●	●	●	●	●	

Table 4. NOS Monitoring Products

Summary and Next Steps

This report characterizes NOS's existing and planned operational monitoring efforts, and outline the proposed process to develop a more integrated coastal environmental monitoring plan for the National Ocean Service. It shows that NOS conducts a wide range of monitoring activities for a variety of purposes at many different scales. The current set of information products and services produced from these activities already meet the needs of many users. However, the inventory illustrates that there are significant information needs not currently being met.

The next step for the committee will be to identify the short- and long-term goals for NOS monitoring, and then identify the gaps in issues, geography, parameters, and time/space scales that are most important to fill. The most challenging of these tasks is developing the vision of an integrated monitoring plan, and then determining which parts of this vision have priority. For example, in 2005, will NOS monitoring activities:

- Document the status and trends in the condition of U.S. coastal environments;
- Characterize and assess problematic conditions in U.S. coastal environments including:
    - *beach closures and related pathogenic indicators;*
    - *eutrophication and its symptoms such as anoxia and hypoxia;*
    - *harmful algal blooms;*
    - *disease conditions in fish and other organisms;*
    - *toxic contaminants and their effects*
    - *losses of major habitat types such as coral reefs, seagrasses, mangroves, and salt marshes;*
    - *introduction of exotic invasive species and their spread; and*
    - *losses in biodiversity.*
- Support real-time forecasting and analysis for coastal natural disaster risk assessment and navigational support services.
- Be used to design and implement environmental regulation, control, mitigation, and restoration projects and programs.
- Assess the success of regulatory and other management actions taken to preserve and enhance coastal environmental quality.

Stated succinctly, will NOS monitoring provide a national capability to measure, understand, analyze, and forecast natural and human-induced environmental change those effects coastal economies, public safety, and the sustained production of ecological goods and services?

To reach this goal, the CEMC will have to consider not only the opportunities for integration among NOS programs, but will have to examine the NOS role in relation to other NOAA programs and within the broader Federal/state coastal monitoring framework. Though this is a formidable task, the result will be to help NOS even more effectively deliver vital environmental information to a broad range of coastal stewards.

Appendix I
Survey of NOS Monitoring Programs and Addendum

November 1999

Survey of NOS Monitoring Programs

This survey inventories major characteristics of NOS' environmental monitoring programs. The results will be used by the NOS' Coastal Environmental Monitoring Committee to better identify important monitoring gaps and to help support the design of a more integrated coastal monitoring program. The survey's "checkbox" design is intended to help standardize responses from NOS programs, although additional response choices may be added, to better capture program activities.

Program Name: _____

_____

_____

Principal Contact: _____

Last Name: _____ First Name: _____

Phone: _____ Ext. _____ Fax: _____

Email: _____

NOS Office: _____

Division: _____

Branch: _____

Mailing Address: _____

Address 1: _____

Address 2: _____

City: _____ State: _____ Zip: _____

Monitoring Purpose:

- ☐ Ecosystem Stressors (State)
- ☐ Ecosystem Health (Response)
- ☐ Program Evaluation (Perform. Measures)
- ☐ Early Warning of Future Problems
- ☐ Other: _____
- ☐ Human Health and Safety
- ☐ Commerce/Sustainable Economy
- ☐ Predictive Model Development

Mandates/Authorizations:

☐ Legislative Other: _____

- ☐ Clean Water Act
- ☐ Clean Air Act
- ☐ Coastal Zone Management Act
- ☐ Marine Protection, Research, and Sanctuaries Act
- ☐ Endangered Species Act
- ☐ Safe Drinking Water Act
- ☐ Toxic Substances Control Act
- ☐ Resource Conservation and Recovery Act
- ☐ Comprehensive Environmental Response, Compensation, and Liability Act

☐ Administrative (Executive Order, etc.) _____

☐ Other: _____

Monitoring Focus: (Information is gathered to characterize ...)

- ☐ Water Quality and/or Quantity
- ☐ Habitat Distribution/Abundance/Biodiversity
- ☐ Socioeconomic Impacts
- ☐ Fish Distribution/Abundance/Biodiversity
- ☐ Sediment Characteristics and Quality
- ☐ Hydrographic and Oceanographic Conditions
- ☐ Shoreline Characteristics and Change
- ☐ Other: _____

Target Parameter Groups: (see Parameter Description attachment for more complete classification of parameters)

- ☐ Birds
- ☐ Geology/Sediments
- ☐ Invertebrates
- ☐ Hydrology
- ☐ Reptiles and Amphibians
- ☐ Physical Oceanography
- ☐ Marine Mammals
- ☐ Water Quality
- ☐ Fishes
- ☐ Air Quality
- ☐ Habitat/Vegetation
- ☐ Human Activities (Socioeconomic)
- ☐ Meteorology
- ☐ Pollution Sources

Temporal Characteristics of Monitoring Efforts:

Period of Record:

Start Date (mmm/yyyy): _____ End Date (mmm/yyyy): _____

☐ Historic ☐ Ongoing ☐ Planned

Frequency of Sampling/Collection:

☐ Hourly ☐ Daily

☐ Monthly ☐ Seasonally

☐ Annually ☐ Decadal

☐ Other: _____

Users/Customers: (please be as specific as possible as to who principally uses information and for what)

☐ NOS Program Use: _____

☐ Federal Government: _____

☐ State Government: _____

☐ Local Government: _____

☐ Regional Entities: _____

☐ Academic: _____

☐ Marine Private Sector: _____

☐ General Public: _____

☐ Congress: _____

☐ Other: _____

Funding Amounts:

FY '97:	☐ < $10K	FY '98:	☐ < $10K	FY '99:	☐ < $10K
	☐ $10K - $100K		☐ $10K - $100K		☐ $10K - $100K
	☐ $100K - $1,000K		☐ $100K - $1,000K		☐ $100K - $1,000K
	☐ > $1,000K		☐ > $1,000K		☐ > $1,000K

Availability of Data:

- ☐ On-line (describe how to access; i.e., Telnet, FTP, URL):_____
- ☐ Off-line (describe how to access):_____
- ☐ Costs (are cost associated with requests - explain):_____
- ☐ Access Constraints (describe any constraints on accessing data):_____
- ☐ Use Constraints (describe any constraints on using the data):_____

Monitoring Tier:

- ☐ Tier I

  Broad scale ecological characterization. Identifies emerging issues and tracks status and trends of coastal ecosystems. Typically, synoptic spatial coverage with more limited temporal resolution and/or ecological parameters.

- ☐ Tier II

  Develops cause and effect relationships among environmental stressors and ecological response variables. Higher spatial and temporal resolution, usually focused in regions or on issues identified through Tier I. Provide data and information directly relevant to remedial action plans.

- ☐ Tier III

  Spatially and temporally intensive at relatively few locations. Generally involves process research related to ecosystem response to environmental stresses.

NOS Monitoring Programs

Addendum to CEMC Survey of NOS Monitoring Programs

NOS Office: _____

Program Name: _____

1. Program Funding for FY 2000:

Funding Sub-Categories	NOS	Partner Funding In	Partner Funding Out	Program Total
Methods Development and Research				
Data Acquisition				
Data Delivery				
Assessment Products				
Total				

Cost ranges ($0 - $100K; $100K - $250K; $250K - $500K; $500K - $1.0M; increase in increments in $500K thereafter).

2. Data and Assessment Products:

What types of data and assessment products are produced and made available by this monitoring program? (check all boxes that apply).

Monitoring Information Type	Data Delivery Formats: Digital Data Sets	CD-Rom	Web Site	Report	Article	Conference Presentation
Raw Data *the data collected directly from instrumentation, with minimal alteration or post processing.*						
Processed Information *derived or summarized information of the raw data (e.g. tide tables).*						
Synthesis Product *interpretations or analyses of data that often include integration with additional data sets (e.g. reports, articles, maps)*						

Other Focus: _____

List Major Products (Do not list specific report titles, but more general descriptions (e.g. a technical report series):

_____

_____

_____

_____

_____

Appendix II
Legislative Mandates

Legislative Mandates And Authorizations for National Ocean Service Monitoring Programs

There are several laws and executive orders that authorize or provide guidance for NOAA/NOS programs and activities, including the establishment of responsibilities for resource management, research and monitoring. The following provides a description of the primary legislative mandates, authorizations and executive orders for NOS programs and activities that currently include a monitoring component. Not all of these authorities provide a specific mandate to do monitoring, but they provide a context for why NOS should or would conduct such monitoring. This section is organized by legislation, and includes the NOS programs and activities that are conducted under the legislation.

CLEAN WATER ACT

Codified under Title 33 - Navigation and Navigable Waters
Chapter 26 U.S.C. - Water Pollution Prevention and Control
Subchaper I - Research and Related Programs

Relates to NOS Programs: National Marine Sancutaries Monitoring, Land Cover Change Analysis, Benthic Habitat Assessment Assessment and Mapping, Prince William Sound Long-term Monitoring Program, and the National Survey on Recreation and the Environment

Sec. 1271. Sediment survey and monitoring
(a) Survey
(1) In general
The Administrator, in consultation with the Administrator of the National Oceanic and Atmospheric Administration and the Secretary, shall conduct a comprehensive national survey of data regarding aquatic sediment quality in the United States. The Administrator shall compile all existing information on the quantity, chemical and physical composition, and geographic location of pollutants in aquatic sediment, including the probable source of such pollutants and identification of those sediments which are contaminated pursuant to section 501(b)(4). [1]

(b) Monitoring
(1) In general
The Administrator, in consultation with the Administrator of the National Oceanic and Atmospheric Administration and the Secretary, shall conduct a comprehensive and continuing program to assess aquatic sediment quality. The program conducted pursuant to this subsection shall, at a minimum -
(A) identify the location of pollutants in aquatic sediment;
(B) identify the extent of pollutants in sediment and sediments which are contaminated pursuant to section 501(b)(4); [1]
(C) establish methods and protocols for monitoring the physical, chemical, and biological effects of pollutants aquatic sediment and of contaminated sediment;
(D) develop a system for the management, storage, dissemination of data concerning aquatic sediment quality;
(E) provide an assessment of aquatic sediment quality trends over time;
(F) identify locations where pollutants in sediment may pose a threat to the quality of drinking water supplies, resources, and marine habitats; and
(G) establish a clearing house for information on technology, methods, and practices available for the remediation, decontamination, and control of sediment contamination.

COASTAL AND GEODETIC SURVEY ACT

Codified under Title 33 - Navigation and Navigable Waters
Chapter 17 U.S.C - National Ocean Survey
Subchapter II - Surveys

<u>Relates to NOS Programs:</u> Hydrographic Surveying, Physical Oceanographic Real-Time System, National Water Level Observation Network, Geodesy, and the Coastal Mapping Program

Sec. 883a. Surveys and other activities
To provide charts and related information for the safe navigation of marine and air commerce, and to provide basic data for engineering and scientific purposes and for other commercial and industrial needs, the Secretary of Commerce, is authorized to conduct the following activities: (1) Hydrographic and topographic surveys; (2) Tide and current observations; (3) Geodetic-control surveys; (4) Field surveys for aeronautical charts; (5) Geomagnetic, seismological, gravity, and related geophysical measurements and investigations, and observations for the determination of variation in latitude and longitude.

Sec. 883b. Dissemination of data; further activities
In order that full public benefit may be derived from the operations of the National Ocean Survey by the dissemination of data resulting from the activities herein authorized and of related data from other sources, the Secretary of Commerce is authorized to conduct the following activities: (1) Analysis and prediction of tide and current data; (2) Processing and publication of data, information, compilations, and reports; (3) Compilation and printing of aeronautical charts of the United States, its Territories, and possessions; and, in addition, the compilation and printing of such aeronautical charts covering international airways as are required primarily by United States Civil aviation; (4) Compilation and printing of nautical charts of the United States, its Territories, and possessions; (5) Distribution of aeronautical charts and related navigational publications required by United States civil aviation; (6) Distribution of nautical charts and related navigational publications for the United States, its Territories, and possessions.

Sec. 883c. Geomagnetic data; collection, correlation, and dissemination
To provide for the orderly collection of geomagnetic data from domestic and foreign sources, and to assure that such data shall be readily available to Government and private agencies and individuals, the National Ocean Survey is designated as the central depository of the United States Government for geomagnetic data, and the Secretary of Commerce is authorized to collect, correlate, and disseminate such data.

Sec. 883d. Improvement of methods, instruments, and equipments; investigations and research
To improve the efficiency of the National Ocean Survey and to increase engineering and scientific knowledge, the Secretary of Commerce is authorized to conduct developmental work for the improvement of surveying and cartographic methods, instruments, and equipments; and to conduct investigations and research in geophysical sciences (including geodesy, oceanography, seismology, and geomagnetism).

Sec. 883e. Cooperative agreements for surveys and investigations; contribution of costs incurred by National Oceanic and Atmospheric Administration

(1) The Secretary of Commerce is authorized to enter into cooperative agreements with, and to receive and expend funds made available by, any State or subdivision thereof, any Federal agency, or any public or private organization, or individual, for surveys or investigations authorized herein, or for performing related surveying and mapping activities, including special-purpose maps, and for the preparation and publication of the results thereof. (2) The Secretary of Commerce is authorized to establish the terms of any cooperative agreement entered into under this section, including the amount of funds to be received, and may contribute that portion of the costs incurred by the National Oceanic and Atmospheric Administration, including shiptime and personnel expenses, which the Secretary determines represents the amount of benefits derived by the Administration from the cooperative agreement.

Sec. 883f. Contracts with qualified organizations

The Secretary of Commerce is authorized to contract with qualified organizations for the performance of any part of the authorized functions of the National Ocean Survey when he deems such procedure to be in the public interests.

Sec. 883h. Employment of public vessels

The President is authorized to cause to be employed such of the public vessels as he deems it expedient to employ, and to give such instructions for regulating their conduct as he deems proper in order to carry out the provisions of this subchapter.

Sec. 883i. Authorization of appropriations

There are authorized to be appropriated such funds as may be necessary to acquire, construct, maintain, and operate ships, stations, equipment, and facilities and for such other expenditures, including personal services at the seat of government and elsewhere and including the erection of temporary observatory buildings and lease of sites therefor, as may be necessary for the conduct of the activities herein authorized.

Sec. 883j. Ocean satellite data

The Administrator of the National Oceanic and Atmospheric Administration (hereinafter referred to in this subtitle as the ‘’Administration”) shall take such actions, including the sponsorship of applied research, as may be necessary to assure the future availability and usefulness of ocean satellite data to the maritime community.

Sec. 883k. Acquisition of land for facilities

For fiscal year 1990 and hereafter funds appropriated under this heading shall be available for acquisition of land for facilities.

COASTAL ZONE MANAGEMENT ACT

Codified under Title 16 - Conservation, Chapter 33 U.S.C. - Coastal Zone Management

Relates to NOS Programs: Florida Keys NMS Zone Monitoring, South Florida Benthic Community Monitoring, Harmful Algal Bloom Monitoring, National Marine Sanctuaries Monitoring, National Estuarine Research Reserve System-wide Monitoring Program, Land Cover Change Analysis, Behtnhic Habitat Assessment and Mapping, and the National Survey on Recreation and the Environment

§ 1455b. Protecting Coastal Waters (Section 6217)

(d) Technical assistance. The Secretary and the Administrator shall provide technical assistance to coastal states and local governments in developing and implementing programs under this section. Such assistance shall include--

(1) methods for assessing water quality impacts associated with coastal land uses;

(2) methods for assessing the cumulative water quality effects of coastal development;

(3) maintaining and from time to time revising an inventory of model ordinances, and providing other assistance to coastal States and local governments in identifying, developing, and implementing pollution control measures; and

(4) methods to predict and assess the effects of coastal land use management measures on coastal water quality and designated uses.

(g) Guidance for coastal nonpoint source pollution control.

(2) Content. Guidance under this subsection shall include, at a minimum--

(F) any necessary monitoring techniques to accompany the measures to assess over time the success of the measures in reducing pollution loads and improving water quality. (emphasis added)

§ 1461. National Estuarine Research Reserve System

(d) Promotion and coordination of estuarine research. The Secretary shall take such action as is necessary to promote and coordinate the use of the System for research purposes

(e) Financial assistance.

(1) The Secretary may, in accordance with such rules and regulations as the Secretary shall promulgate, make grants--

(B) to any coastal state or public or private person for purposes of supporting research and monitoring within a national estuarine reserve that are consistent with the research guidelines developed under subsection (c). (emphasis added)

COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT

Codified under Title 42 - The Public Health and Welfare
Chapter 103 U.S.C. - Comprehensive Environmental Response, Compensation, and Liability
Subchapter I - Hazardous Substances Releases, Liability, Compensation

Relates to NOS Programs: Prince William Sound Long-term Monitoring Program, and the National Survey on Recreation and the Environment

§ 9604. Response authorities.
(b) Investigations, monitoring, coordination, etc., by President
(1) Information; studies and investigations
Whenever the President is authorized to act pursuant to subsection (a) of this section, or whenever the President has reason to believe that a release has occurred or is about to occur, or that illness, disease, or complaints thereof may be attributable to exposure to a hazardous substance, pollutant, or contaminant and that a release may have occurred or be occurring, he may undertake such investigations, monitoring, surveys, testing, and other information gathering as he may deem necessary or appropriate to identify the existence and extent of the release or threat thereof, the source and nature of the hazardous substances, pollutants or contaminants involved, and the extent of danger to the public health or welfare or to the environment. In addition, the President may undertake such planning, legal, fiscal, economic, engineering, architectural, and other studies or investigations as he may deem necessary or appropriate to plan and direct response actions, to recover the costs thereof, and to enforce the provisions of this chapter.

(2) Coordination of investigations
The President shall promptly notify the appropriate Federal and State natural resource trustees of potential damages to natural resources resulting from releases under investigation pursuant to this section and shall seek to coordinate the assessments, investigations, and planning under this section with such Federal and State trustees.

CORAL REEF TASK FORCE

Executive Order 13089: Coral Reef Protection

Relates to NOS Programs: Coral Reef Mapping, Coral Reef Monitoring

Sec. 3. Federal Agency Responsibilities.
In furtherance of section 2 of this order, Federal agencies whose actions affect U.S. coral reef ecosystems, shall, subject to the availability of appropriations, provide for implementation of measures needed to research, monitor, manage, and restore affected ecosystems, including, but not limited to, measures reducing impacts from pollution, sedimentation, and fishing. To the extent not inconsistent with statutory responsibilities and procedures, these measures shall be developed in cooperation with the U.S. Coral Reef Task Force and fishery management councils and in consultation with affected States, territorial, commonwealth, tribal, and local government agencies, nongovernmental organizations, the scientific community, and commercial interests.

Sec. 5. Duties of the U.S. Coral Reef Task Force.
(a) Coral Reef Mapping and Monitoring.
The Task Force, in cooperation with State, territory, commonwealth, and local government partners, shall coordinate a comprehensive program to map and monitor U.S. coral reefs. Such programs shall include, but not be limited to, territories and commonwealths, special marine protected areas such as National Marine Sanctuaries, National Estuarine Research Reserves, National Parks, National Wildlife Refuges, and other entities having significant coral reef resources. To the extent feasible, remote sensing capabilities shall be developed and applied to this program and local communities should be engaged in the design and conduct of programs.

(b) Research.
The Task Force shall develop and implement, with the scientific community, research aimed at identifying the major causes and consequences of degradation of coral reef ecosystems. This research shall include fundamental scientific research to provide a sound framework for the restoration and conservation of coral reef ecosystems worldwide. To the extent feasible, existing and planned environmental monitoring and mapping programs should be linked with scientific research activities. This Executive order shall not interfere with the normal conduct of scientific studies on coral reef ecosystems.

ENDANGERED SPECIES ACT

Codified under Title 16 - Conservation, Chapter 35 U.S.C. - Endangered Species

Relates to NOS Programs: National Marine Sanctuaries Monitoring

§ 1533. Determination of endangered species and threatened species.

(g) Monitoring.
(1) The Secretary [of Commerce] shall implement a system in cooperation with the States to monitor effectively for not less than years the status of all species which have recovered to the point at which the measures provided pursuant to this chapter are no longer necessary and which, in accordance with the provisions of this section, have been removed from either of the lists published under subsection (c) of this section

(2) The Secretary shall make prompt use of the authority under paragraph 7 [2] of subsection (b) of this section to prevent a significant risk to the well being of any such recovered species.

MARINE MAMMAL PROTECTION ACT

Codified under Title 16 - Conservation
Chapter 31 - Marine Mammal Protection
Subchapter II - Conservation and Protection of Marine Mammals

Relates to NOS Programs: National Marine Sanctuaries Monitoring

Sec. 1386. Stock assessments

(a) In general

Not later than August 1, 1994, the Secretary [of Commerce] shall, in consultation with the appropriate regional scientific review established under subsection (d) of this section, prepare a draft stock assessment for each marine mammal stock occurs in waters under the jurisdiction of the United States. Each draft stock assessment, based on the best information available, shall -

(1) describe the geographic range of the affected stock, including any seasonal or temporal variation in such range;

(2) provide for such stock the minimum population estimate, current and maximum net productivity rates, and current population trend, including a description of the information upon which these are based;

(3) estimate the annual human-caused mortality and injury of the stock by source and, for a strategic stock, other factors that may be causing a decline or impeding recovery of stock, including effects on marine mammal habitat and prey;

(4) describe commercial fisheries that interact with the stock, including -

(A) the approximate number of vessels actively participating in each such fishery;

(B) the estimated level of incidental mortality and serious injury of the stock by each such fishery on an annual basis;

(C) seasonal or area differences in such incidental mortality or serious injury; and

(D) the rate, based on the appropriate standard unit of fishing effort, of such incidental mortality and serious injury, and an analysis stating whether such level insignificant and is approaching a zero mortality and serious injury rate;

(5) categorize the status of the stock as one that either -

(A) has a level of human-caused mortality and serious injury that is not likely to cause the stock to be reduced below its optimum sustainable population; or

(B) is a strategic stock, with a description of the reasons therefor; and

(6) estimate the potential biological removal level for the stock, describing the information used to calculate it, including the recovery factor.

MARINE PROTECTION, RESEARCH, AND SANCTUARIES ACT

Relates to NOS Programs: NS&T Mussel Watch, NS&T Bioeffects Survey, NS&T Benthic Surveillance, Coastal Intensive Site Network, National Marine Sanctuary Monitoring, Land Cover Change Analysis, Benthic Habitat Assessment and Mapping, Prince William Sound Long-term Monitoring Program, Socioeconomic Monitoring for Florida Keys National Marine Sanctuary, and the National Survey on Recreation and the Environment

OCEAN DUMPING ACT
(Also known as Titles I and II of the Marine Protection, Research, and Sanctuaries Act)

Codified under Title 33 - Navigation and Navigable Waters,
Chapter 27 U.S.C. - Ocean Dumping Act
Subchapter II - Research

Sec. 1441. Monitoring and research program

The Secretary of Commerce, in coordination with the Secretary of the Department in which the Coast Guard is operating and with the Administrator shall, within six months of October 23, 1972, initiate a comprehensive and continuing program of monitoring and research regarding the effects of the dumping of material into ocean waters or other coastal waters where the tide ebbs and flows or into the Great Lakes or their connecting waters. (emphasis added)

Sec. 1442. Research program respecting possible long-range effects of pollution, overfishing, and man-induced changes of ocean ecosystems

(a) Secretary of Commerce

> *(1) The Secretary of Commerce, in close consultation with other appropriate Federal departments, agencies, and instrumentalities shall, within six months of October 23, 1972, initiate a comprehensive and continuing program of research with respect to the possible long-range effects of pollution, overfishing, and man-induced changes of ocean ecosystems. These responsibilities shall include the scientific assessment of damages to the natural resources from spills of petroleum or petroleum products. In carrying out such research, the Secretary of Commerce shall take into account such factors as existing and proposed international policies affecting oceanic problems, economic considerations involved in both the protection and the use of the oceans, possible alternatives to existing programs, and ways in which the health of the oceans may best be preserved for the benefit of succeeding generations of mankind.*
>
> *(2) The Secretary of Commerce shall ensure that the program under this section complements, when appropriate, the activities undertaken by other Federal agencies pursuant to subchapter I of this chapter and section 1443 of this title. That program shall include but not be limited to -*
>
> > *(A) the development and assessment of scientific techniques to define and quantify the degradation of the marine environment;*
> > *(B) the assessment of the capacity of the marine environment to receive materials without degradation;*

(C) continuing monitoring programs to assess the health of the marine environment, including but not limited to the monitoring of bottom oxygen concentrations, contaminant levels in biota, sediments, and the water column, diseases in fish and shellfish, and changes in types and abundance of indicator species; (emphasis added)

NATIONAL MARINE SANCTUARIES ACT
(Also known as Title III of the Marine Protection, Research and Sanctuaries Act)
Codified under Title 16 - Conservation, Chapter 32 U.S.C. - Marine Sanctuaries

Sec. 1440. Research, monitoring, and education
(a) In general

The Secretary shall conduct research, monitoring, evaluation, and education programs as are necessary and reasonable to carry out the purposes and policies of this chapter.

(b) Promotion and coordination of sanctuary use

The Secretary shall take such action as is necessary and reasonable to promote and coordinate the use of national marine sanctuaries for research, monitoring, and education purposes. Such action may include consulting with Federal agencies, States, local governments, regional agencies, interstate agencies, or other persons to promote use of one or more sanctuaries for research, monitoring and education, including coordination with the National Estuarine Research Reserve System. (emphasis added)

NATIONAL COASTAL MONITORING ACT
(Also known as Title V of the Marine Protection, Research and Sanctuaries Act)
Codified under Title 33 - Codified under Title 33 - Navigation and Navigable Waters, Chapter 41 U.S.C. - National Coastal Monitoring

Title V of the MPRSA, added in 1992 (P.L. 102-587), establishes a national coastal water quality monitoring program. It directs EPA and NOAA jointly to implement a long-term program to collect and analyze scientific data on the environmental quality of coastal ecosystems, including ambient water quality, health and quality of living resources, sources of environmental degradation, and data on trends. Results of these activities (including intensive monitoring of key coastal waters) are intended to provide information necessary to design and implement effective programs under the Clean Water Act and Coastal Zone Management Act. The National Coastal Monitoring Act included authorizations for appropriations through fiscal year 1996, but funds have never been appropriated.

Sec. 2801. Purposes
The purposes of this chapter are to -
(1) establish a comprehensive national program for consistent monitoring of the Nation's coastal ecosystems;
(2) establish long-term water quality assessment and monitoring programs for high priority coastal

waters that will enhance the ability of Federal, State, and local authorities to develop and implement effective remedial programs for those waters;
(3) establish a system for reviewing and evaluating the scientific, analytical, and technological means that are available for monitoring the environmental quality of coastal ecosystems;
(4) establish methods for identifying uniform indicators of coastal ecosystem quality;
(5) provide for periodic, comprehensive reports to Congress concerning the quality of the Nations coastal ecosystems;
(6) establish a coastal environment information program to distribute coastal monitoring information;
(7) provide state [1] programs authorized under the Coastal Zone Management Act of 1972 (16 U.S.C. 1451 et seq.) with information necessary to design land use plans and coastal zone regulations that will contribute to the protection of coastal ecosystems; and
(8) provide certain water pollution control programs authorized under the Federal Water Pollution Control Act (33 U.S.C. 1251 et seq.) with information necessary to design and implement effective coastal water pollution controls. (emphasis added)

OIL POLLUTION ACT 1990

Codified under Title 33 - Navigation and Navigable Waters,
Chapter 40 U.S.C. - Oil Pollution

Relates to NOS Programs: National Marine Sanctuaries Monitoring, Prince William Sound Long-term Monitoring Program

Subchapter I - Oil Pollution Liability and Compensation

Sec. 2706. Natural resources
(e) Damage assessment regulations
(1) Regulations
The President, acting through the Under Secretary of Commerce for Oceans and Atmosphere and in consultation with the Administrator of the Environmental Protection Agency, the Director of the United States Fish and Wildlife Service, and the heads of other affected agencies, not later than 2 years after August 18, 1990, shall promulgate regulations for the assessment of natural resource damages under section 2702(b)(2)(A) of this title resulting from a discharge of oil for the purpose of this Act.

Subchapter II - Prince William Sound Provisions

Sec. 2731. Oil Spill Recovery Institute
(a) Establishment of Institute
The Secretary of Commerce shall provide for the establishment of a Prince William Sound Oil Spill Recovery Institute (hereinafter in this section referred to as the ''Institute") through the Prince William Sound Science and Technology Institute located in Cordova, Alaska.
(b) Functions
The Institute shall conduct research and carry out educational and demonstration projects designed

to - (1) identify and develop the best available techniques, equipment, and materials for dealing with oil spills in the arctic and subarctic marine environment; and (2) complement Federal and State damage assessment efforts and determine, document, assess, and understand the long-range effects of Arctic or Subarctic oil spills on the natural resources of Prince William Sound and its adjacent waters (as generally depicted on the map entitled ''EXXON VALDEZ oil spill dated March 1990''), and the environment, the economy, and lifestyle and well-being of the people who are dependent on them, except that the Institute shall not conduct studies or make recommendations on any matter which is not directly related to Arctic or Subarctic oil spills or the effects thereof.

(f) Evaluation

The Secretary of Commerce may conduct an ongoing evaluation of the activities of the Institute to ensure that funds received by the Institute are used in a manner consistent with this section.

(k) Research

The Institute shall publish and make available to any person upon request the results of all research, educational, and demonstration projects conducted by the Institute. The Administrator shall provide a copy of all research, educational, and demonstration projects conducted by the Institute to the National Oceanic and Atmospheric Administration.

Subchapter IV - Oil Pollution Research and Development Program

Sec. 2761. Oil pollution research and development program

(a) Interagency Coordinating Committee on Oil Pollution Research

(2) Purposes

The Interagency Committee shall coordinate a comprehensive program of oil pollution research, technology development, and demonstration among the Federal agencies, in cooperation and coordination with industry, universities, research institutions, State governments, and other nations, as appropriate, and shall foster cost-effective research mechanisms, including the joint funding of research.

OUTER CONTINENTAL SHELF LANDS ACT

Codified under Title 43- Public Lands, Chapter 29 U.S.C. - Submerged Lands
Subchapter III - Outer Continental Shelf Lands

<u>Relates to NOS Programs:</u> National Survey on Recreation and the Environment

Sec. 1346. Environmental studies

(b) Additional studies subsequent to leasing and development of area:

Subsequent to the leasing and developing of any area or region, the Secretary shall conduct such additional studies to establish environmental information as he deems necessary and shall monitor the human, marine, and coastal environments of such area or region in a manner designed to provide time-series and data trend information which can be used for comparison with any previously collected data for the purpose of identifying any significant changes in the quality and productivity of such environments, for establishing trends in the areas studied and monitored, and for designing experiments to identify the causes of such changes.

(f) Utilization of capabilities of Department of Commerce:

In executing his responsibilities under this section, the Secretary shall, to the maximum extent practicable, enter into appropriate arrangements to utilize on a reimbursable basis the capabilities of the Department of Commerce. In carrying out such arrangements, the Secretary of Commerce is authorized to enter into contracts or grants with any person, organization, or entity with funds appropriated to the Secretary of the Interior pursuant to this subchapter.

South Florida Ecosystem Restoration Taskforce operates under provisions of the

WATER RESOURCES DEVELOPMENT ACT OF 1996

S640, Public Law 104-303,
Section 528 - Everglades and South Florida Ecosystem

Relates to NOS Programs: National Marine Sanctuaries Monitoring

f. SOUTH FLORIDA ECOSYSTEM RESTORATION TASK FORCE
1. ESTABLISHMENT AND MEMBERSHIP-
There is established the South Florida Ecosystem Restoration Task Force, which shall consist of the following members (or, in the case of a Federal agency, a designee at the level of assistant secretary or an equivalent level):
[includes the Secretary of Commerce]

Interagency Agreement on South Florida Ecosystem Restoration:
THIS AGREEMENT is made and entered into this 23rd day of September 1993, by and between the Department of the Interior, Department of Commerce, Department of the Army (Civil Works), Environmental Protection Agency, Department of Justice, and Department of Agriculture to promote and facilitate coordinated Federal actions to restore the South Florida Ecosystem.

Article III. Interagency Working Group
B. Working Group Responsibilities:
Task Force Working Group shall:
3. *Develop and ecosystem-based science program, water quality management strategies, and a multi-species recovery plan.*
4. *Evaluate the effectiveness of ongoing actions to restore and maintain the South Florida ecosystem and recommend modification of such actions when appropriate.*

SURVEY OF THE COAST ACT

Act of Feb. 10, 1807, Ses. II, ch. 8, 2 Stat. 413-14 (1807)
NINTH CONGRESS. SESS II. CH. 5, 8. 1807
CHAP. VIII. An Act to provide for surveying the coasts of the United States.

Relates to NOS Programs: Hydrographic Surveying, and the Coastal Mapping Program

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the President of the United States shall be, and he is hereby authorized and requested, to cause a survey to be taken of the coasts of the United States, in which shall be designated the islands and shoals, with the roads or places of anchorage, within twenty leagues of any part of the shores of the United States; and also the respective courses and distances between the principal capes, or head lands, together with such other matters as he may deem proper for completing an accurate chart of every part of the coasts within the extent aforesaid.

SEC. 2. *And be it further enacted, That it shall be lawful for the President of the United States to cause such examinations and observations to be made, with respect to St. George's bank, and any other bank or shoal and the soundings and currents beyond the distance aforesaid to the Gulf Stream, as in his opinion may be especially subservient to the commercial interests of the United States.*

SEC. 3. *And be it further enacted, That the President of the United States shall be, and he is hereby authorized and requested, for any of the purposes aforesaid, to cause proper and intelligent persons to be employed, and also such of the public vessels in actual service, as he may judge expedient, and to give such instructions for regulating their conduct as to him may appear proper, according the tenor of this act.*

SEC. 4. *And be it further enacted, That for carrying this act into effect there shall be, and hereby is appropriated, a sum not exceeding fifty thousand dollars, to be paid out of any monies in the treasury, not otherwise appropriated.*

Appendix III

Map Layouts by Program Office

Contents

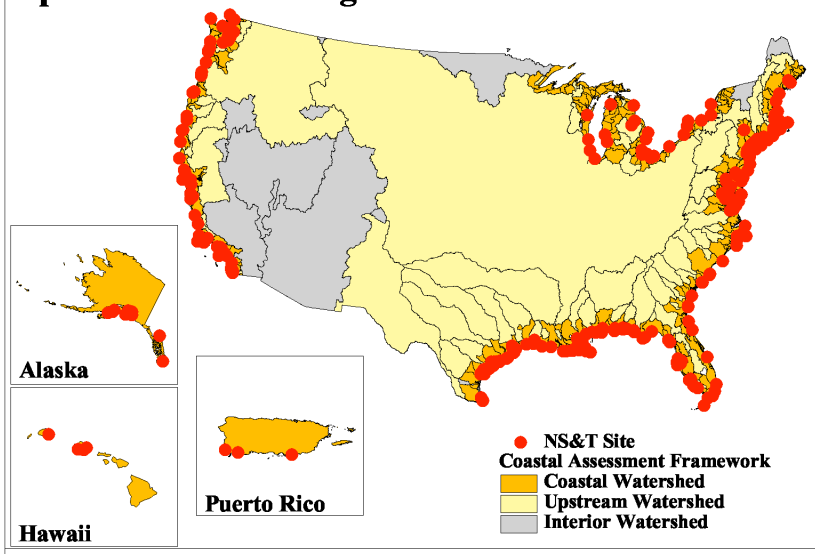
Maps Currently Under Development:

NOS Environmental Monitoring Inventory

National Centers for Coastal Ocean Science (NCCOS)

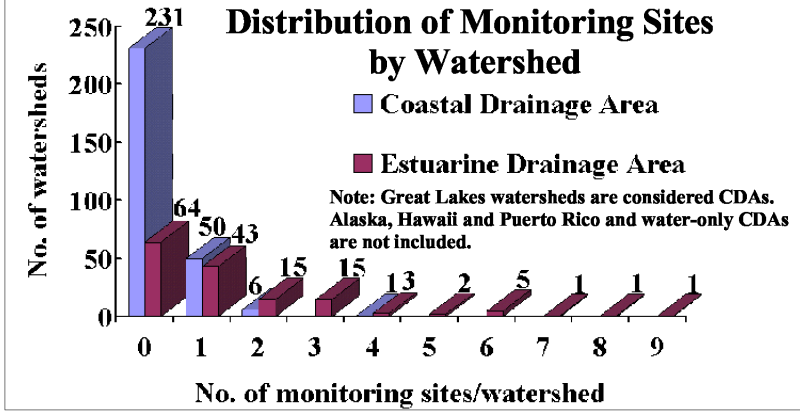
National Status and Trends (NS&T) - Mussel Watch

Spatial Extent of Program

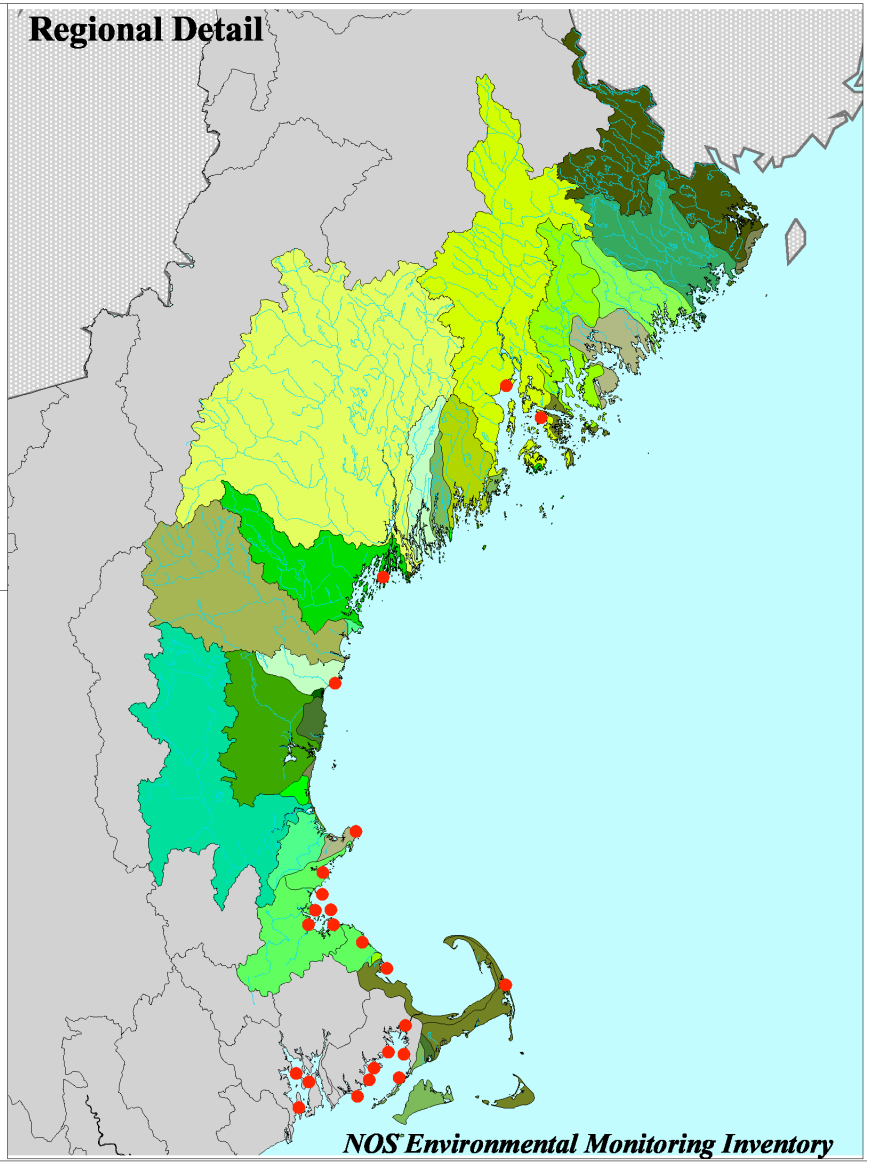


Program Facts

- Monitors organic and inorganic contaminants in sediments and mollusks.
- Period of record starts December 1986 and is ongoing.
- Frequency of sampling/collection is annual, biannual, and every 5-10 years depending on the parameter.



Regional Detail

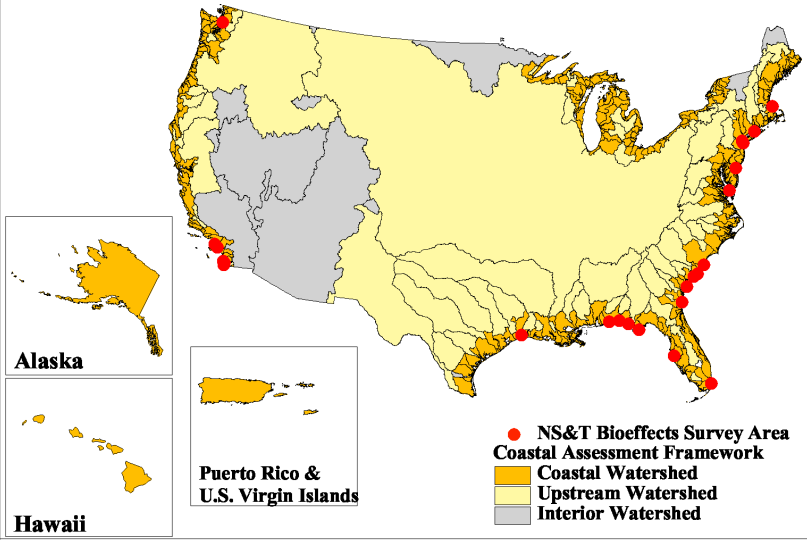


NOS Environmental Monitoring Inventory

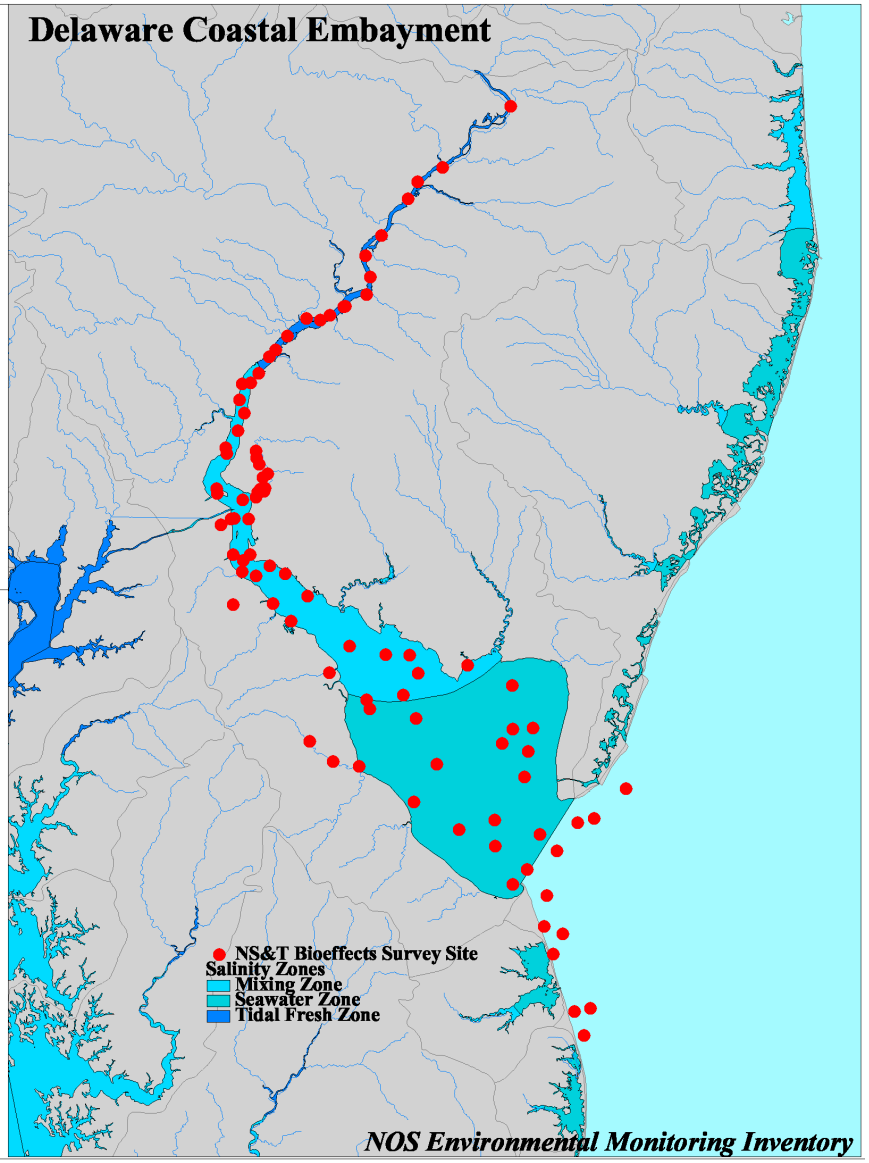
National Centers for Coastal Ocean Science (NCCOS)

National Status and Trends (NS&T) - Bioeffects Survey

Spatial Extent of Program



Delaware Coastal Embayment



Program Facts

- Period of record starts in 1989 and is ongoing. Recent surveys listed below.

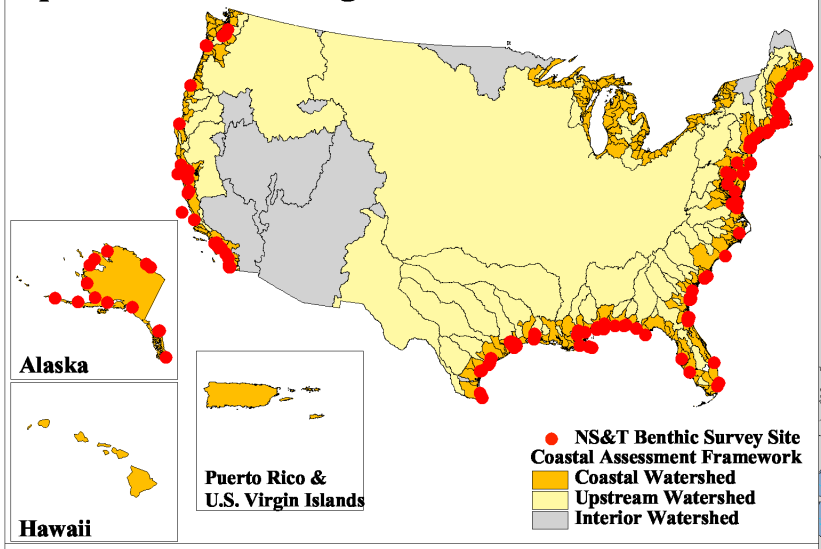
Survey Area	Total Survey Area (sq mi)	No. of Samples	Date of Survey
Boston Harbor	56.1	55	Jun/Jul 1993
Long Island Sound Bays	71.9	60	Aug 1991
Hudson-Raritan Esty.	350.0	117	Mar/May 1991
Newark Bay	12.7	57	Jan/Mar 1993
Winyah Bay	7.3	9	Jun 1993
Charleston Harbor	41.1	63	Jun/Jul 1994
Leadenwah Creek	1.7	9	Jun/Jul 1994
Savannah River	13.1	60	May 1995
St. Simon Sound	24.6	20	Aug 1992/93
Biscayne Bay	484.2	226	Jun 1994/95
Tampa Bay	550.0	165	Jun 1994
Apalachicola Bay	187.6	9	May 1993
Choctawatchee Bay	254.5	39	Jun 1994
St. Andrew Bay	127.0	31	May 1993
Pensacola Bay	245.9	66	Aug 1995
Sabine Lake	245.9	66	Aug 1995
S. Cal. Small Estuaries	5.0	30	Aug/Sep 1994
San Pedro Bay	53.8	105	Jul, Sep 1992
Mission Bay	6.1	11	Mar/Aug 1993
San Diego River	0.5	2	Mar/Aug 1993
San Diego Bay	34.0	117	Mar/Aug 1993
Tijuana River	0.3	6	Mar/Aug 1993
Delaware Bay	na	92	1997
Chesapeake Bay	na	approx. 200	1998-2000
Puget Sound	na	approx. 300	1997-99

NOS Environmental Monitoring Inventory

National Centers for Coastal Ocean Science (NCCOS)

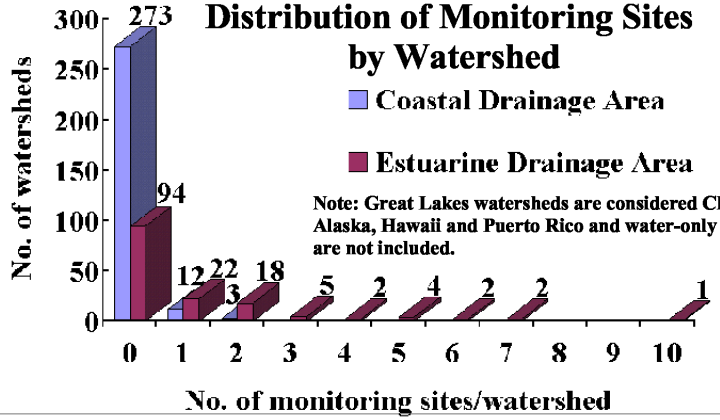
National Status and Trends (NS&T) - Benthic Surveillance

Spatial Extent of Program

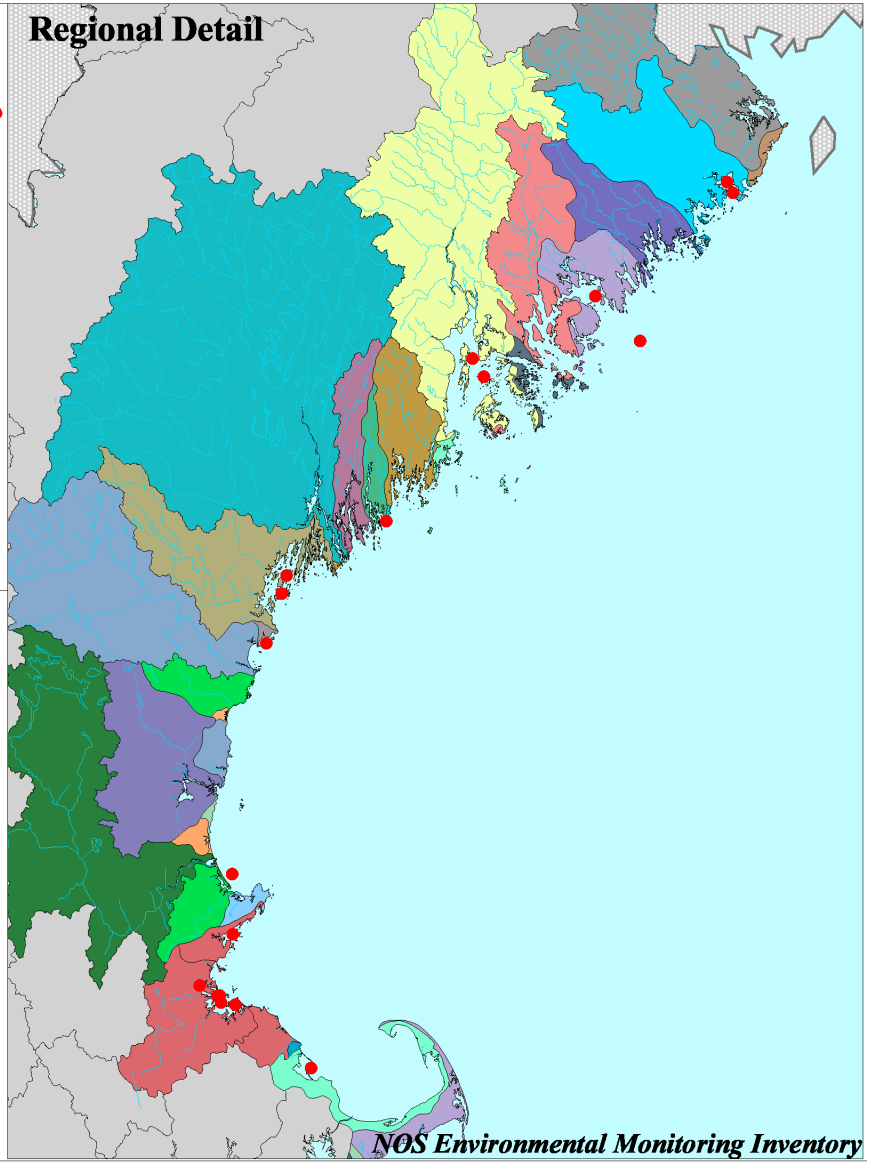


Program Facts

- Period of record starts June 1984 and ends September 1993.
- Frequency of sampling/collection is annual, bi-annual, and every four years depending on the parameter.



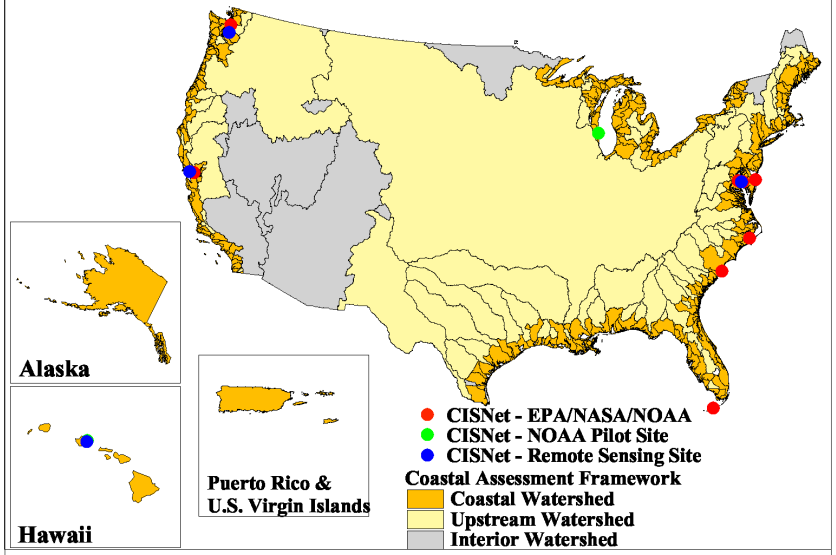
Regional Detail



National Centers for Coastal Ocean Science (NCCOS)

Coastal Intensive Site Network (CISNet)

Spatial Extent of Program



Program Areas

CISNet Site	Type
Neuse River Estuary, North Carolina	NASA/NOAA/EPA
Florida Keys National Marine Sanctuary, Florida	NASA/NOAA/EPA
San Pablo Bay, California	NASA/NOAA/EPA
Delaware's Inland Bays, Delaware	NASA/NOAA/EPA
San Pablo Bay, California	Remote Sensing
Southwestern Lake Michigan, Wisconsin	NOAA/EPA
North Inlet-Winyah Bay National Estuarine Research Reserve, South Carolina	NASA/NOAA/EPA
Rhode River embayment, Maryland	NASA/NOAA/EPA
Puget Sound, Washington	NASA/NOAA/EPA
Puget Sound, Washington	Remote Sensing
Kaneohe Bay, Hawaii	NOAA/EPA
Kaneohe Bay, Hawaii	Remote Sensing
Choptank River, Maryland	NASA/NOAA/EPA
Choptank River, Maryland	Remote Sensing

Program Facts

- Monitors information on water quality and/or quantity to gauge ecosystem health, early warning of future problems, and ecostressors.
- Period of record starts December 1986 and is ongoing.
- Frequency of sampling/collection ranges from hourly to seasonally.

Summary for the Two NOAA/EPA CISNet Sites

Southwestern Lake Michigan, Wisconsin

- Will continue a 50-year nearshore sample record, supplementing it with an offshore station, to provide a tool for assessment of systematic environmental change.

Kaneohe Bay, Hawaii

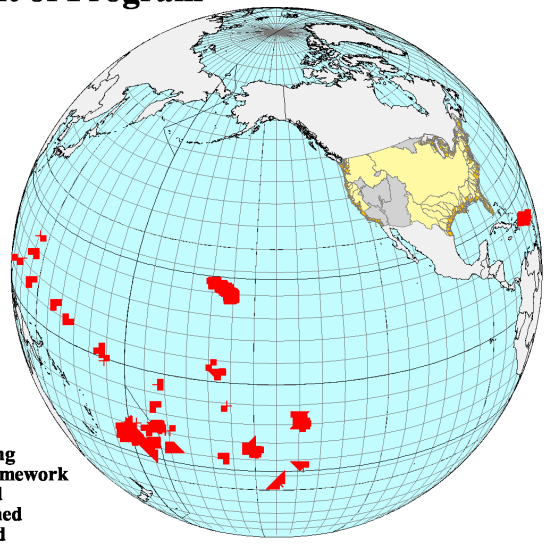
- Will identify natural indicators of environmental stress with potential for remote sensing, to enable rapid identification and spatial resolution of impacts.

NOS Environmental Monitoring Inventory

National Centers for Coastal Ocean Science (NCCOS)

Coral Reef Mapping

Spatial Extent of Program

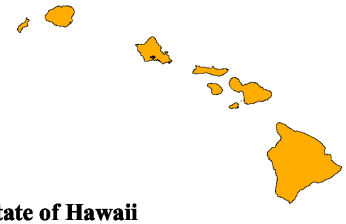


Coral Reef Mapping
Coastal Assessment Framework
Coastal Watershed
Upstream Watershed
Interior Watershed

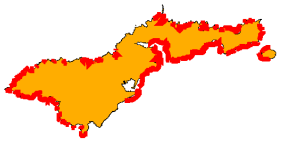
Regional Views

Coral Reef (General Location)

Puerto Rico
U.S. Virgin Islands



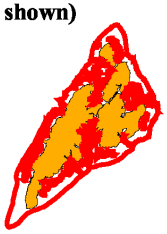
State of Hawaii
(Eight main islands shown)

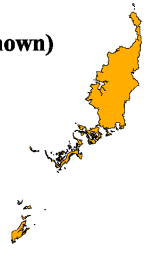


American Samoa
(Tutuila Island shown)

Guam

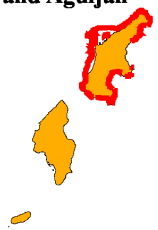
Federated States of Micronesia
(Yap Island shown)





Palau
(Major islands shown)

Northern Mariana Islands
(Saipan, Tinian and Aguijan
Islands shown)



Midway Island

Program Facts

- Goal is to produce comprehensive digital coral reef ecosystem maps for all States, Commonwealths, Territories and Freely Associated States of the U.S. in seven years.
- Mapping and Information Synthesis working group participants include at least 15 non-government organizations; 15 State, Commonwealth, Territory, and Freely Associated State agencies; and 14 federal agencies.
- Existing technologies in use include: Airborne Light Detection and Ranging (LIDAR); in-situ side-scan and multi-beam SONAR; in-situ multispectral systems; airborne hyperspectral systems; and satellite hyperspectral systems.
- Satellite technologies holding promise for future coral reef assessments include: Landsat-7, ORBIMAGE, Naval EarthMap Observer (NEMO) , and the National Technical Means satellites.

NOS Environmental Monitoring Inventory

National Centers for Coastal Ocean Science (NCCOS)

South Florida Benthic Community Monitoring

Spatial Extent of Program

Benthic Community Monitoring Sites

Coastal Assessment Framework

- Coastal Watershed
- Upstream Watershed
- Interior Watershed

Program Facts

- At each site, the following operations are conducted:

  CTD profile or YSI readings at surface and bottom

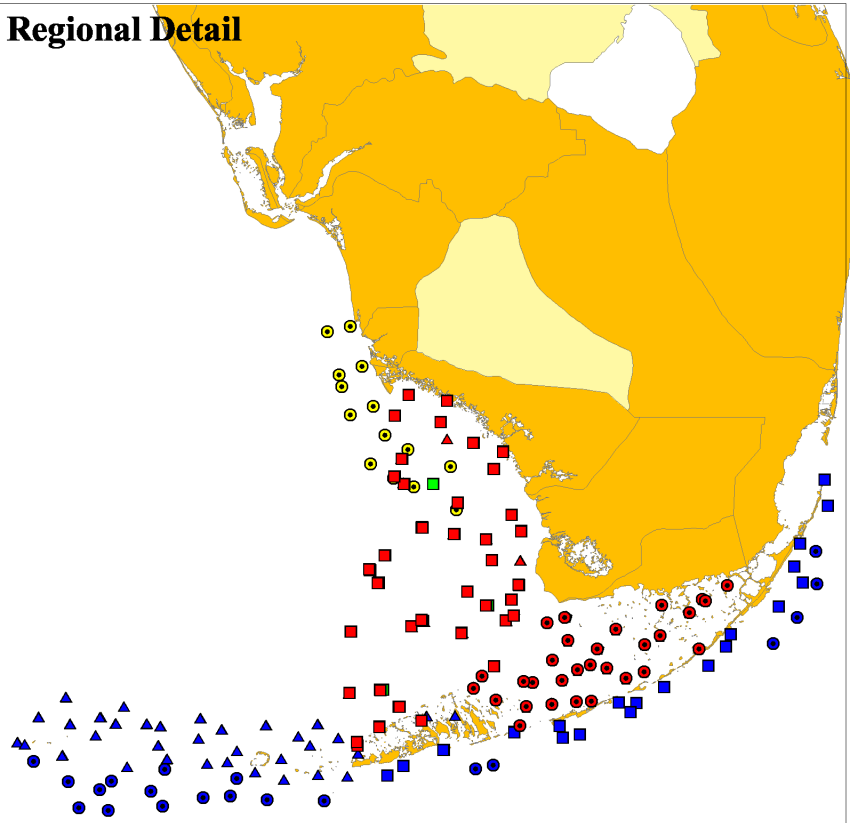
  Young grab for sediment type and grain size

  Three Young grabs for benthic evaluation

  One Young grab for percent silt/clay, percent water content, and total organic carbon.

- Benthic community studies have historically been used in regional estuarine monitoring programs. They have been proven an effective means for describing the extent and magnitude of pollution in estuarine ecosystems, as well as for assessing management actions.

Regional Detail



South Florida Benthic Community Assessment Sites (Location Year)

- Florida Bay & Adjacent Waters 1996
- Florida Bay 1994
- Florida Bay 1995
- Florida Bay 1996
- Florida Bay 1997
- Florida Keys National Marine Sanctuary 1998
- Florida Keys-Dry Tortugas 1997
- Florida Keys-Dry Tortugas 1998
- Rookery Bay 1997

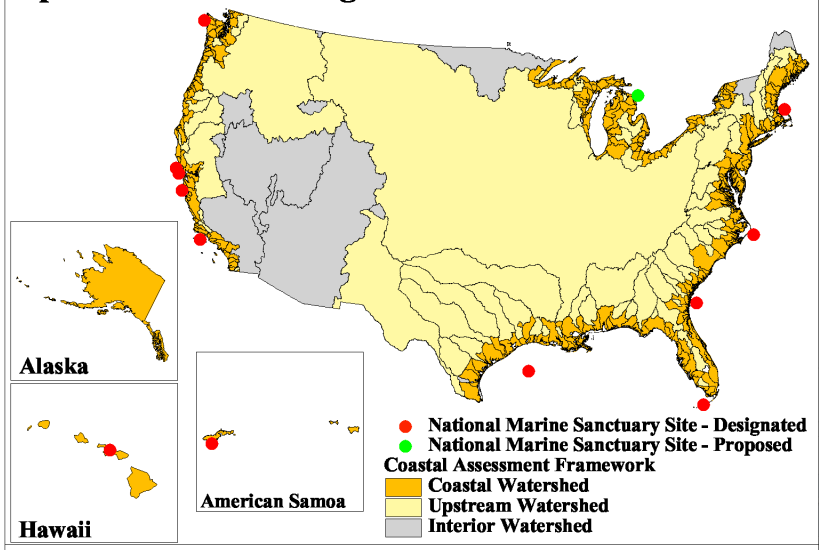
NOS Environmental Monitoring Inventory

NOS Environmental Monitoring Inventory

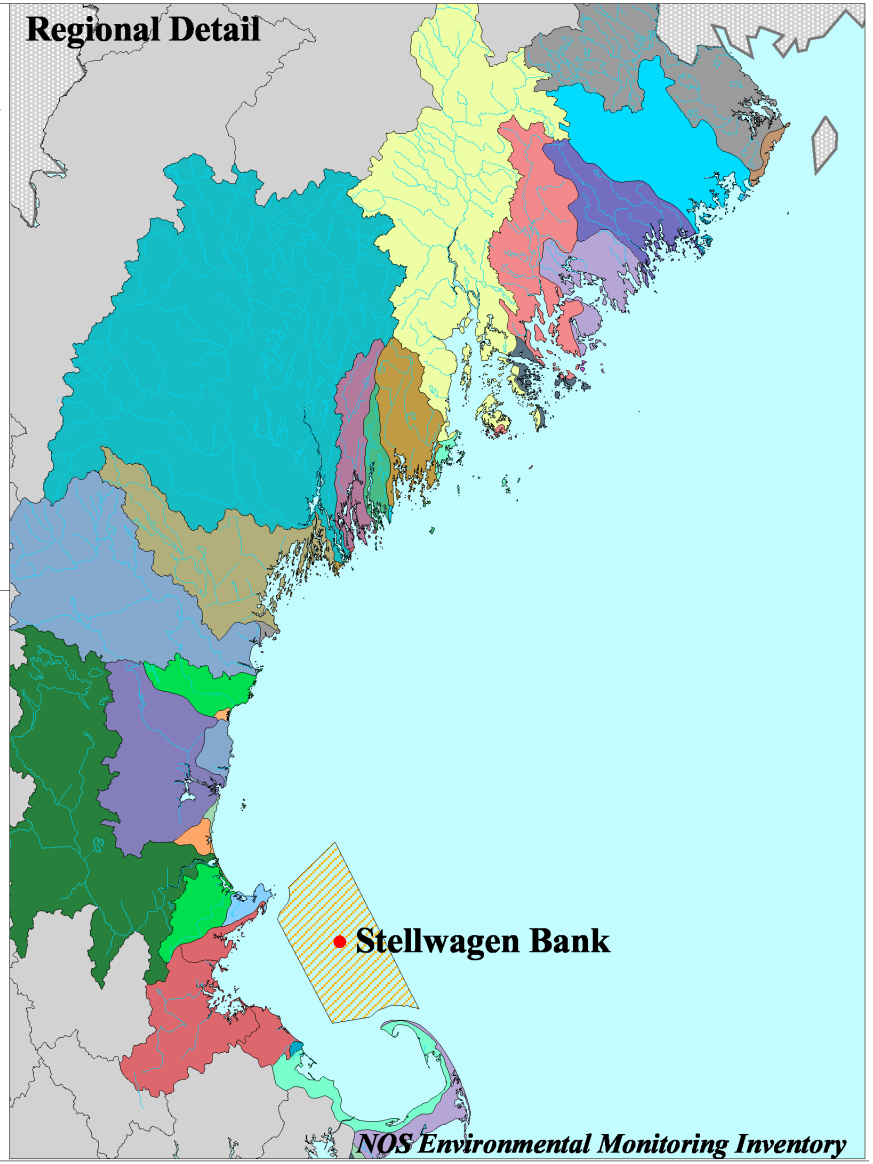
Office of Ocean and Coastal Resource Management (OCRM)

National Marine Sanctuaries

Spatial Extent of Program



Regional Detail



Program Facts

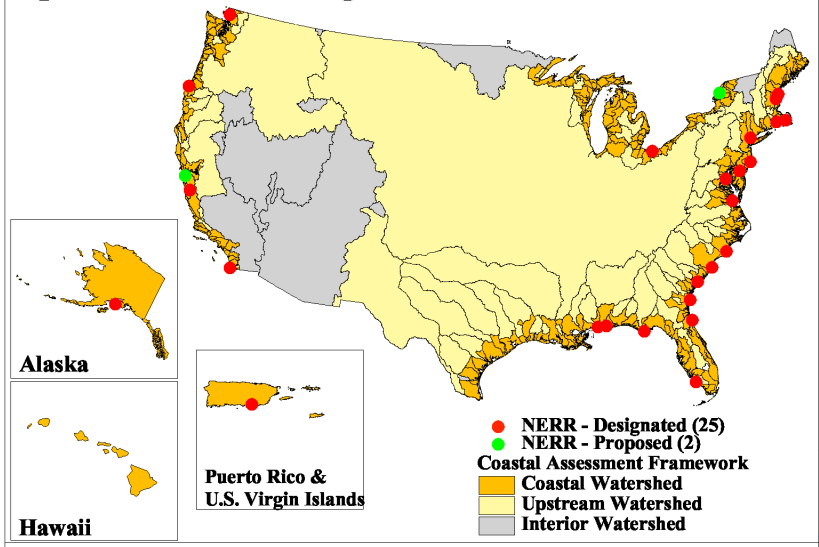
- Sanctuaries were created to protect marine resources like coral reefs, sunken historical vessels or unique habitats while facilitating compatible public and private uses. Sanctuaries are managed by NOAA on a site-by-site basis.
- Program was created by the National Marine Sanctuaries Act in 1972.
- Marine sites with nationally significant aesthetic, ecological, historical, or recreational value can be designated a sanctuary.

NOS Environmental Monitoring Inventory

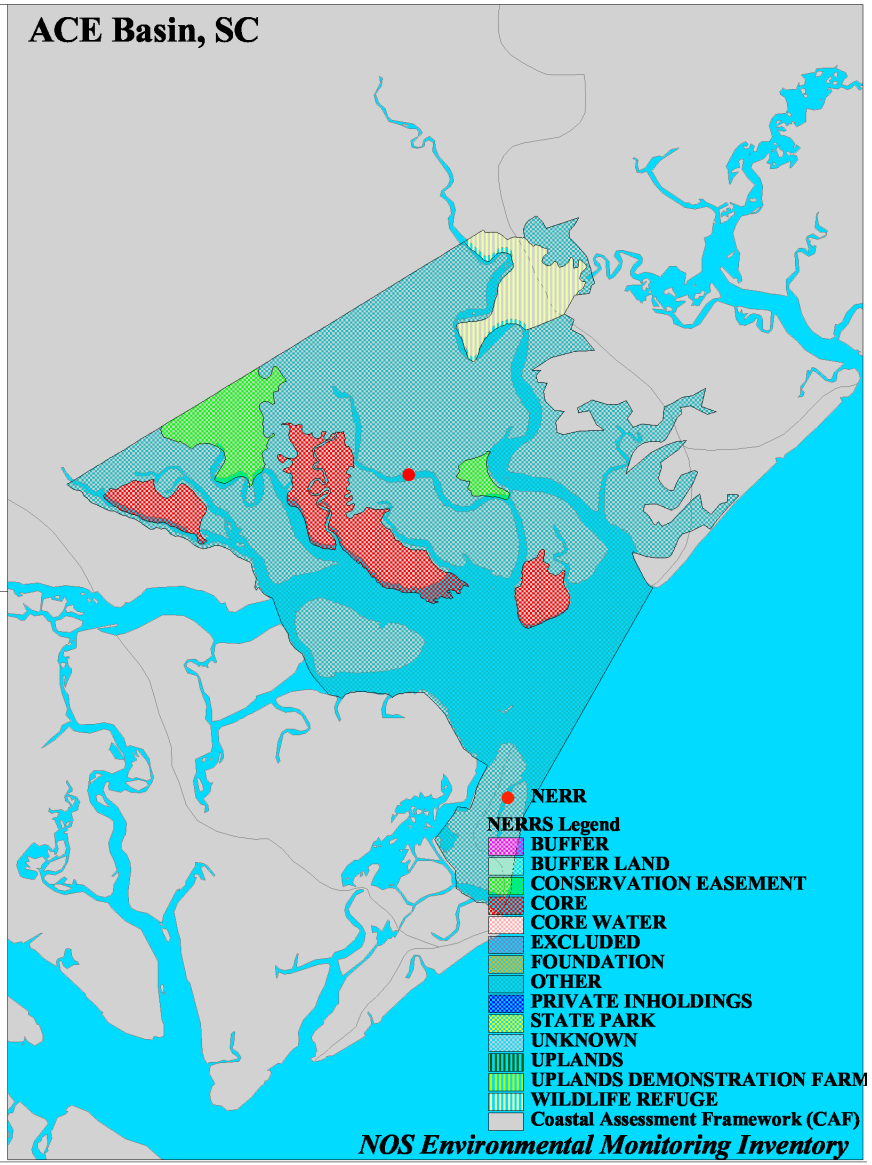
Office of Ocean and Coastal Resource Management (OCRM)

National Estuarine Research Reserve System-wide Monitoring Program (SWMP)

Spatial Extent of Program



ACE Basin, SC



Program Facts

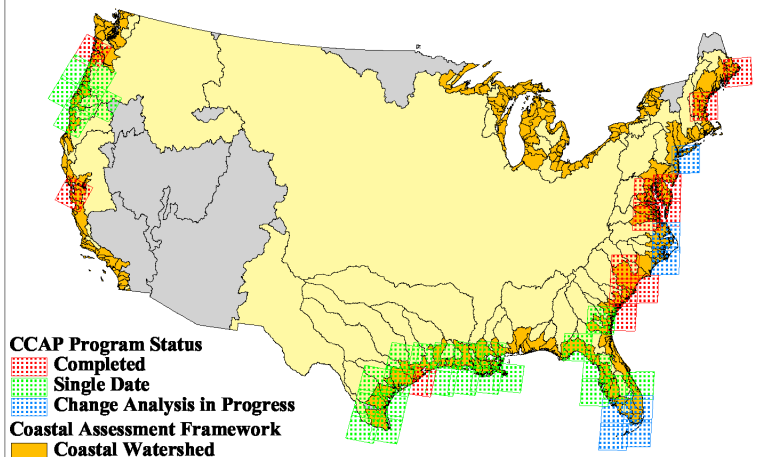
- A network of protected areas (25 designated reserves including 39 separate sites) established in order to improve the health of the nation's estuaries and coastal environments. Each National Estuarine Research Reserve (NERR) is jointly established by a coastal state and NOAA.
- Program was created by the Coastal Zone Management Act (CZMA) of 1972 to augment the federal coastal zone management (CZM) program.
- Reserves are selected to represent different types of estuaries and large biogeographic regions within the nation.
- System-wide Monitoring Program was established in 1996 to collect continuous water quality data, and since 2000, weather data.

NOS Environmental Monitoring Inventory

Coastal Services Center (CSC)

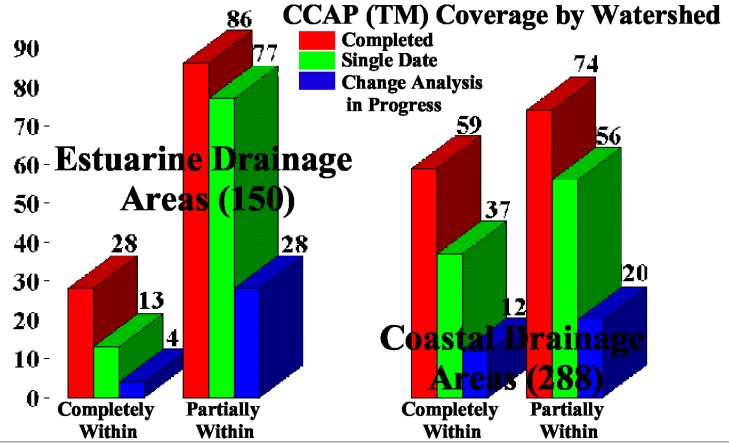
Land Cover Change Analysis (Coastal Change Analysis Program - C-CAP)

Spatial Extent of Program

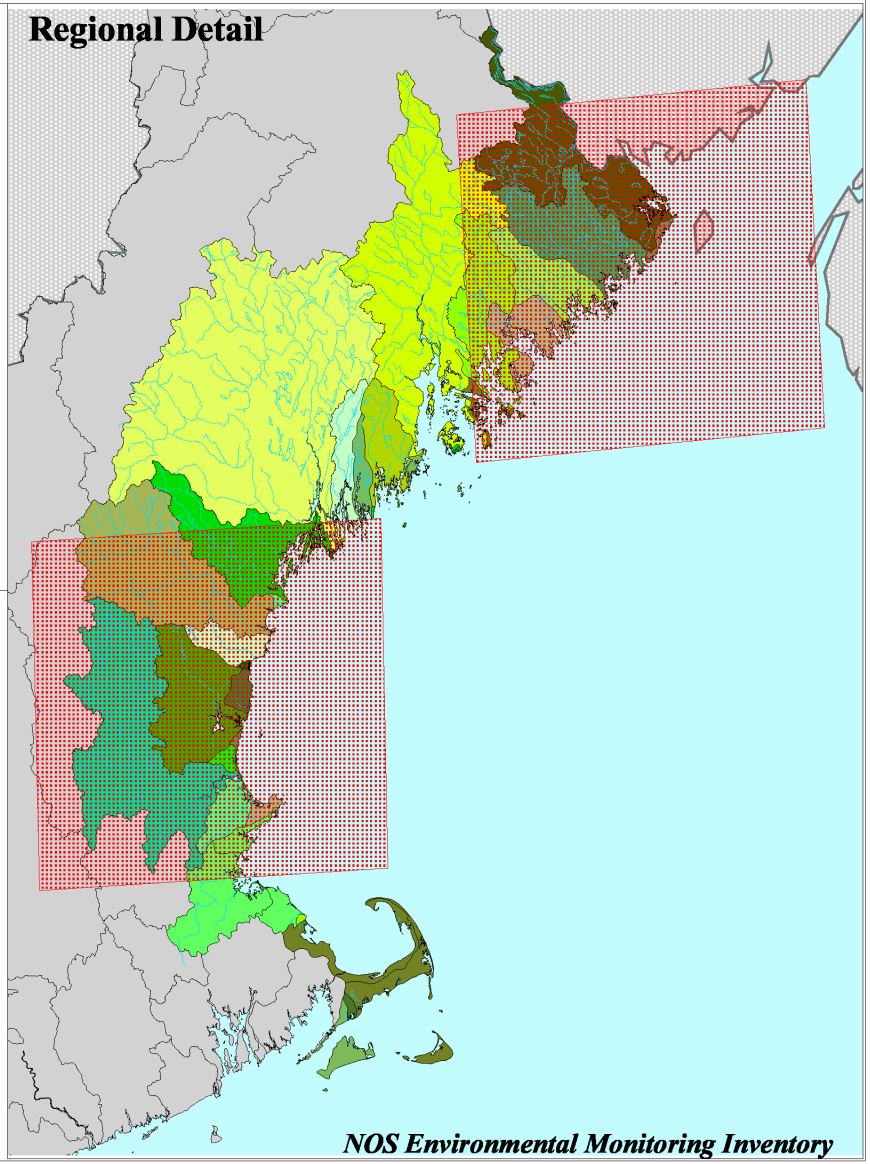


Program Facts

- Developing a nationally standardized database of land cover and habitat change (over a five year period) in coastal regions.
- Period of record starts in 1990 and is ongoing.



Regional Detail

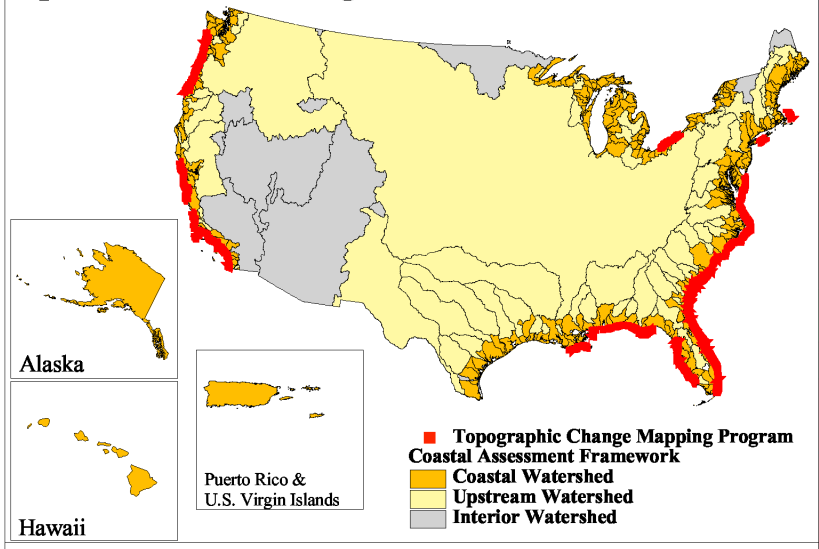


NOS Environmental Monitoring Inventory

Coastal Services Center (CSC)

Topographic Change Mapping

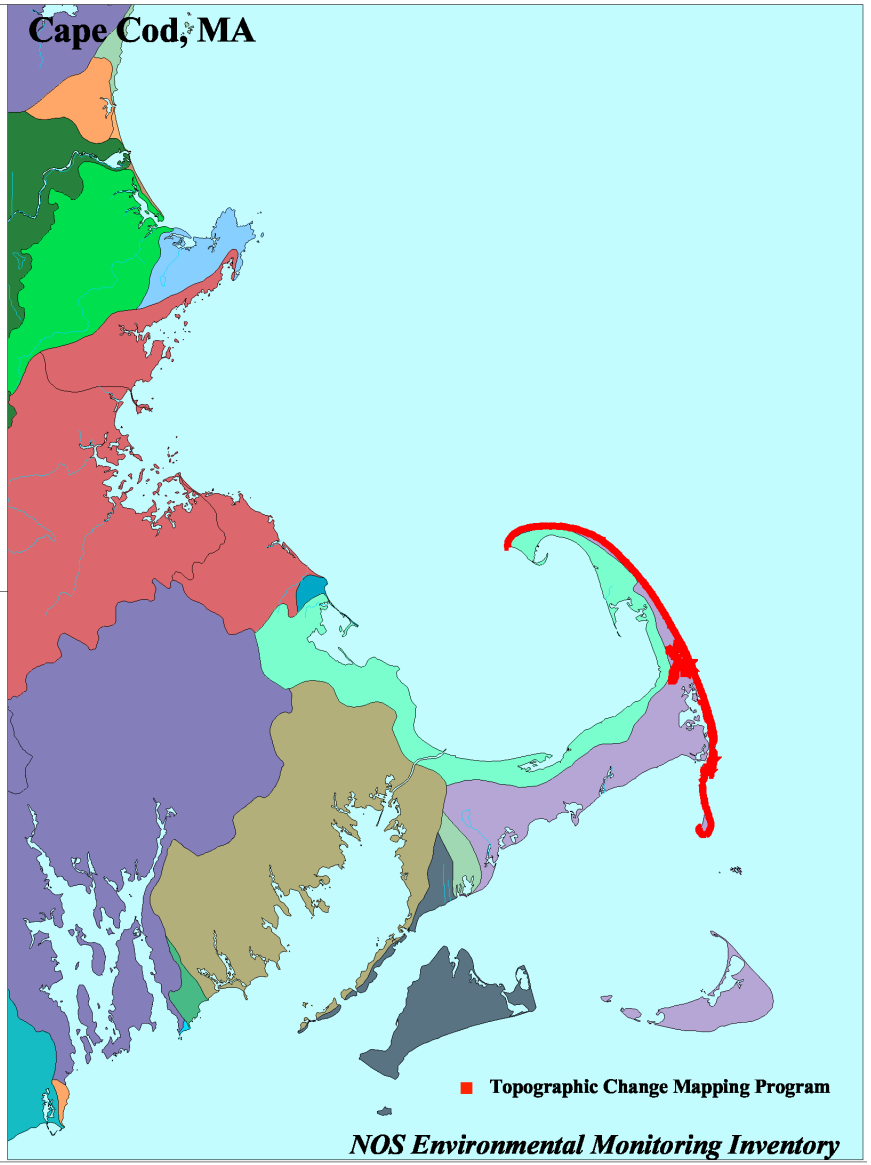
Spatial Extent of Program



Program Facts

- Period of record starts in 1996 and is ongoing.
- Program collects high-resolution topographic and other spatial data sets for information on beach and dune field topography.
- Data collection and analysis is done in partnership with USGS and NASA.
- The program is also working to establish a protocol for operational airborne laser topographic mapping.
- Uses advanced LIDAR (LIght Detection And Ranging) technologies.

Cape Cod, MA

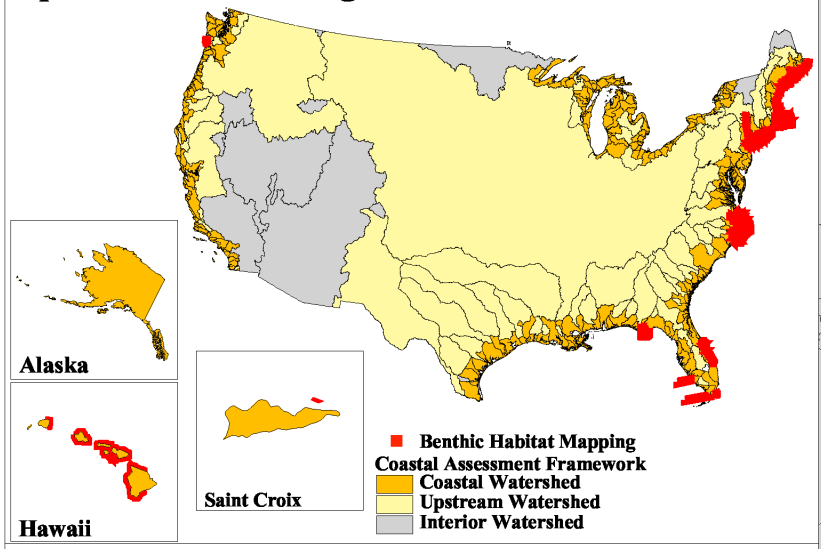


NOS Environmental Monitoring Inventory

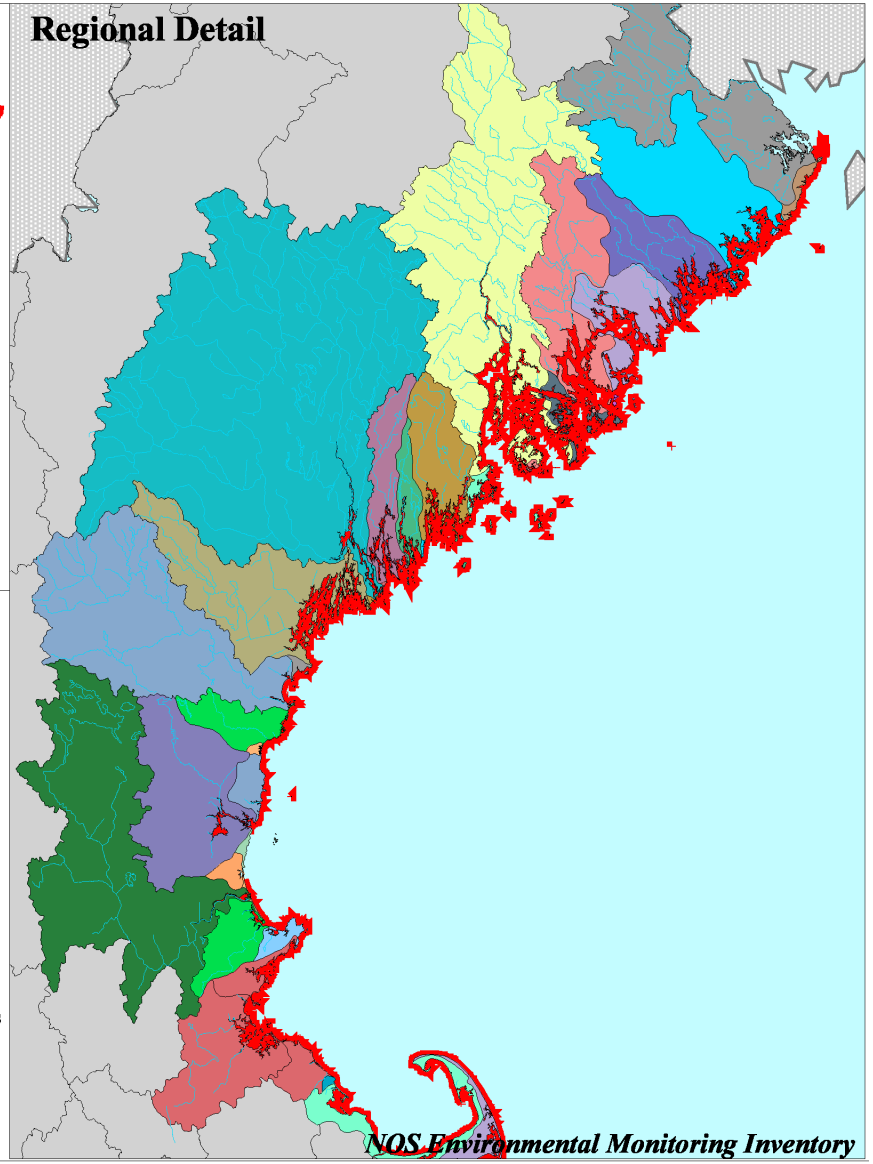
Coastal Services Center (CSC)

Benthic Habitat Mapping

Spatial Extent of Program



Regional Detail



Program Facts

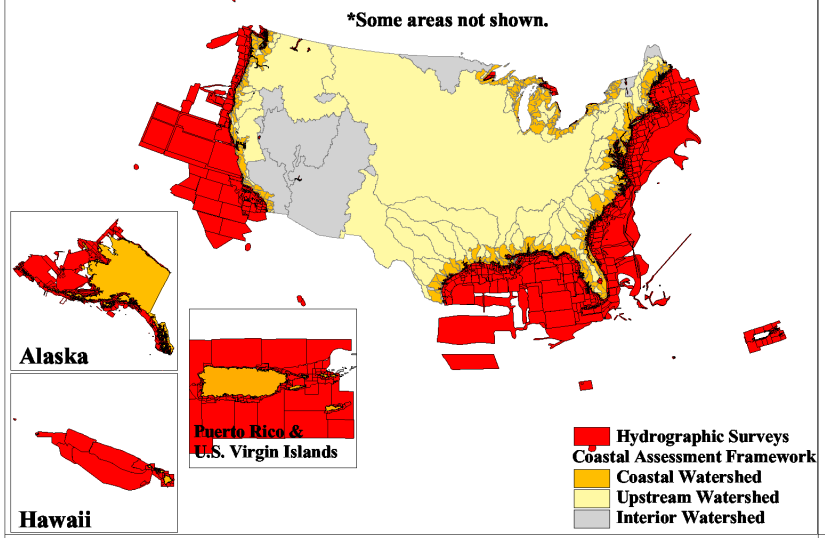
- Period of record starts in 1990 but is variable by project.
- Frequency of sampling/collection is mostly single date but intended for change analysis.
- There are three major components including:
  - Seagrass Mapping and Change Analysis - Part of an effort to create a nationally consistent inventory of the location, extent and change in seagrass and other benthic habitat in coastal areas of the United States using aerial photography, in situ video photography and acoustic sensors.
  - Development of Remote Sensing Techniques for Mapping Coral Reefs - Testing new methods of mapping tropical coral reefs in cooperation with the Coastal Change Analysis Program (C-CAP).
  - Benthic Habitat Monitoring and Assessment - Exploring ways of mapping benthic habitats in waters where satellite and aircraft-derived imagery are not useful, such as in deep and turbid waters or in the case of non-distinct bottom types, using acoustic sensors, underwater video, sediment profile cameras, and benthic grab and sediment samples.

NOS Environmental Monitoring Inventory

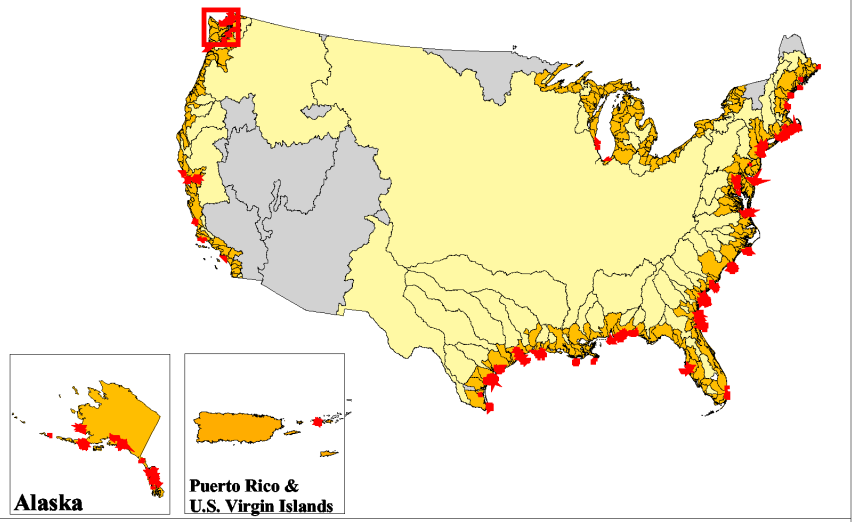
Office of Coast Survey (OCS)

Hydrographic Data Collection

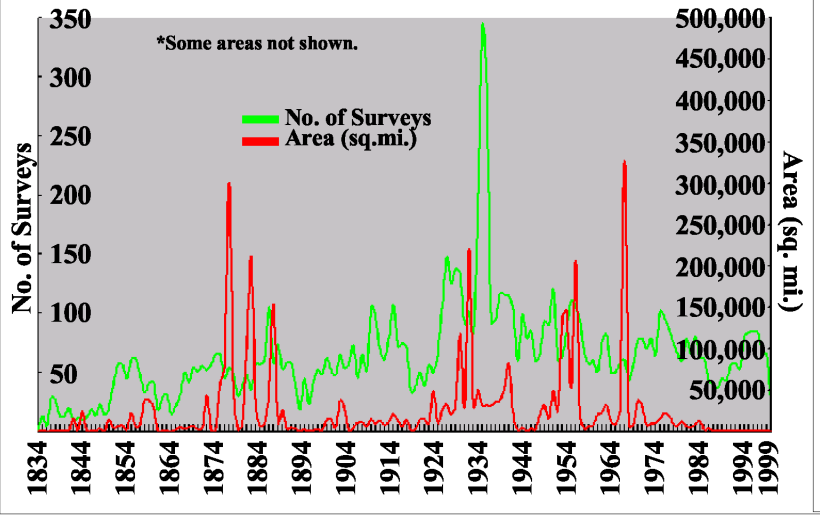
Spatial Extent of Program (Years 1834-1999)



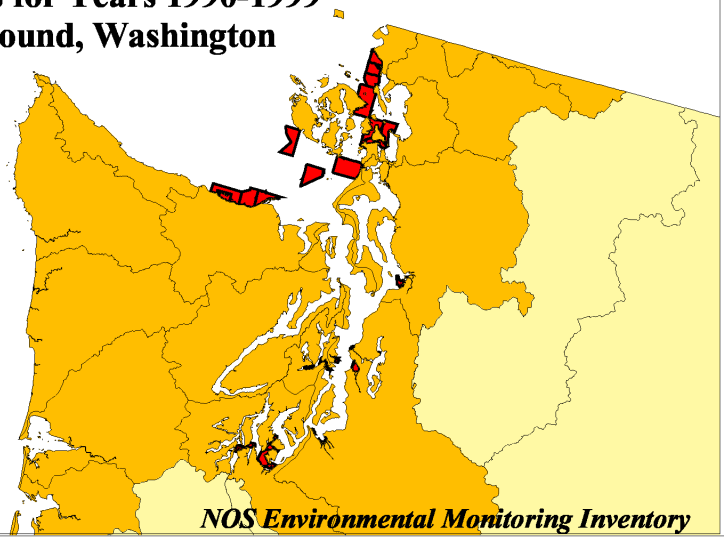
Surveys for Years 1990-1999



Distribution of Hydrographic Surveys by Watershed



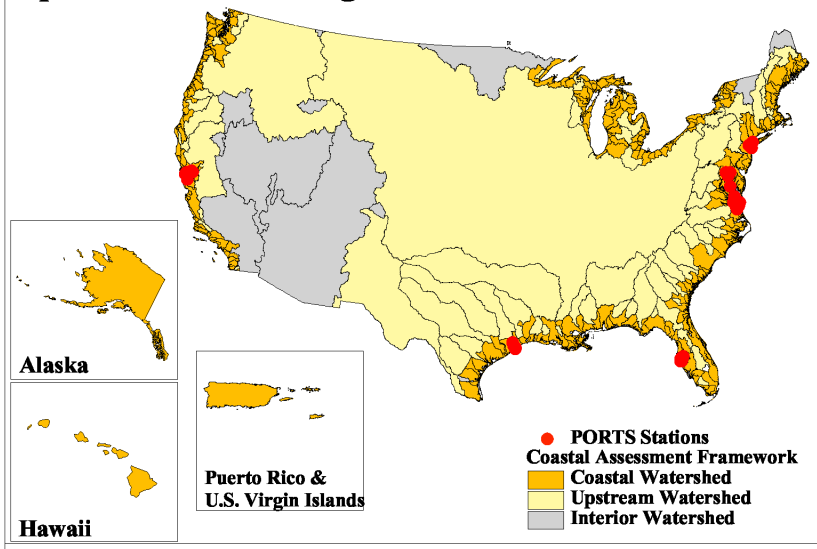
Surveys for Years 1990-1999
Puget Sound, Washington



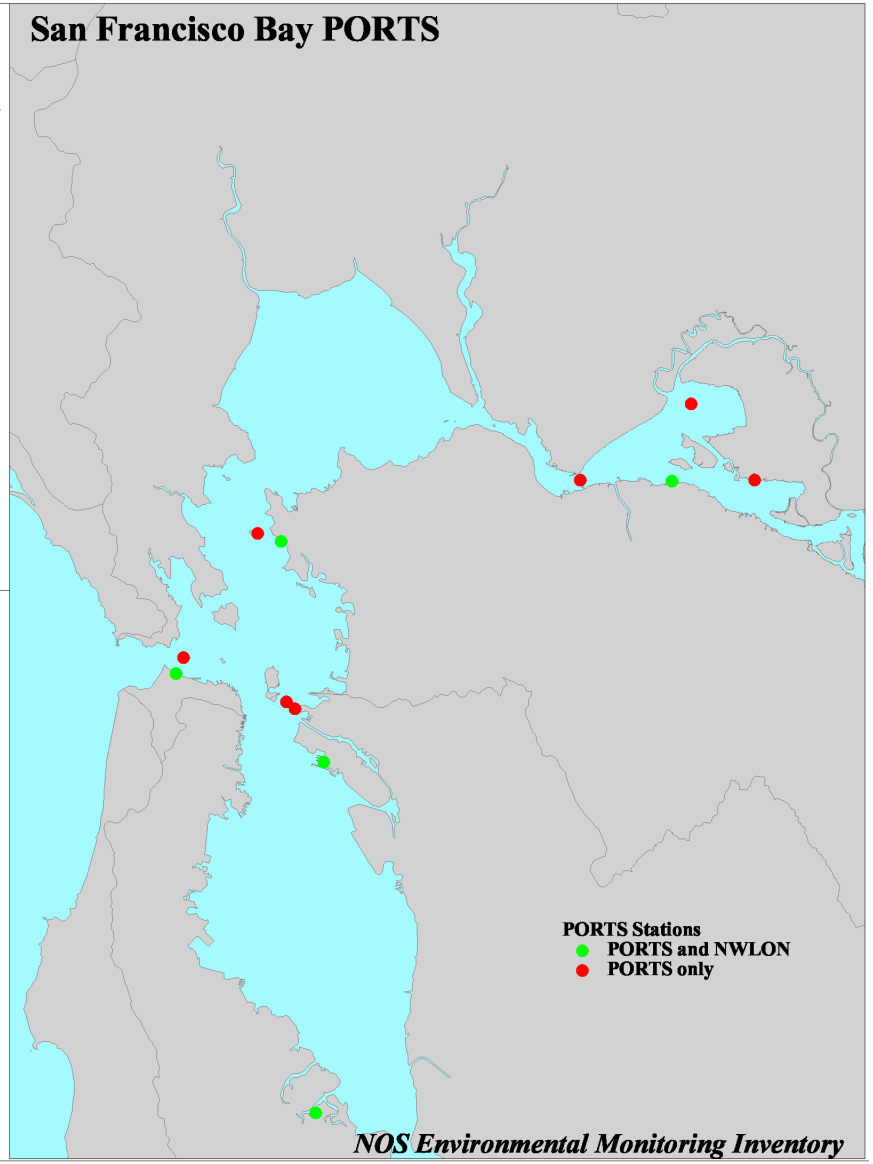
NOS Environmental Monitoring Inventory **Center for Operational Oceanographic Products and Services (CO-OPS)**

Physical Oceanographic Real-Time System (PORTS™)

Spatial Extent of Program



San Francisco Bay PORTS



Program Facts

- Period of record starts in 1996 and is ongoing.
- Frequency of sampling/collection is every six minutes.

Data Products by Number of Locations

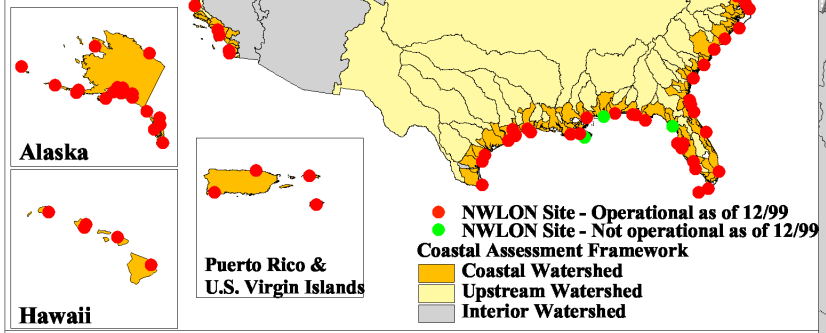
PORTS Name	Water Levels	3 Days Currents	All Meteorological	All Salinity
New York/New Jersey	4	2	3	2
Houston/Galveston	5	2	4	4
Tampa Bay	4	3	5	na
San Francisco	5	5	6	5
Chesapeake Bay LITE	12	na	4	4

NOS Environmental Monitoring Inventory **Center for Operational Oceanographic Products and Services (CO-OPS)**

National Water Level Observation Network (NWLON) - Long Term Water Level Measurement Stations

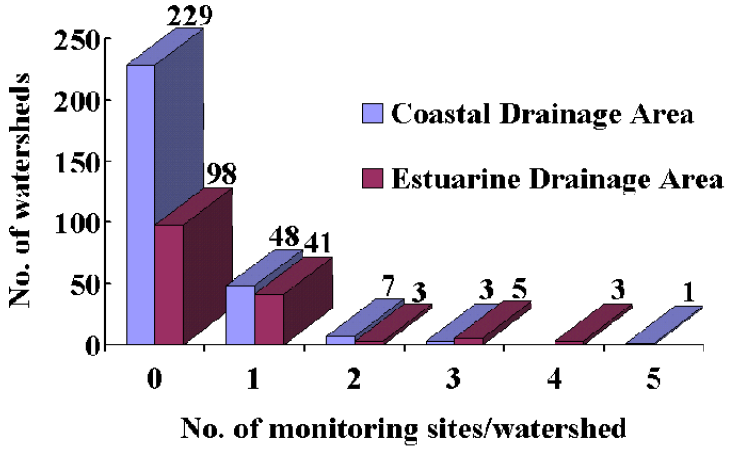
Spatial Extent of Program

Sites Not Shown:
Bermuda, Guam,
Johnston Island,
Marshall Islands,
Samoa,
Midway Islands,
Wake Island

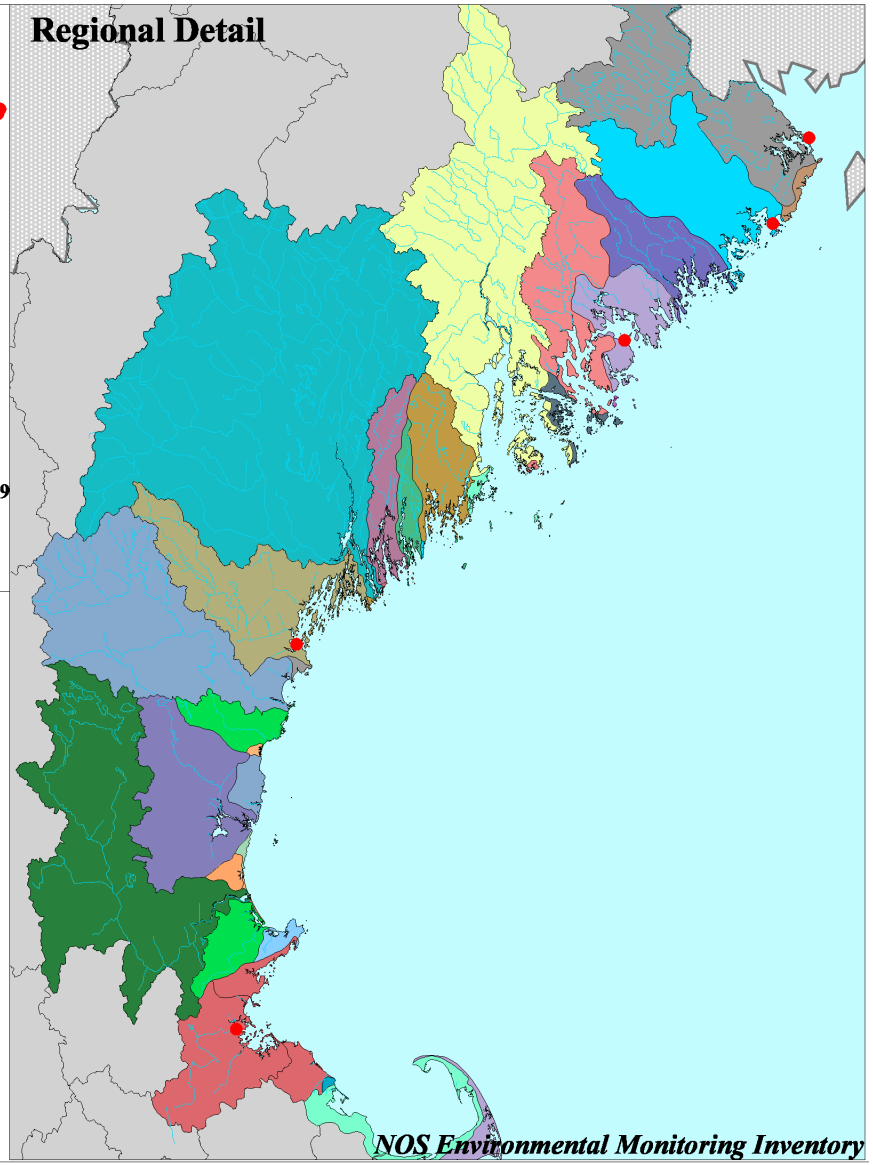


Program Facts

- Period of record starts in the 1850s and is ongoing.
- Frequency of sampling/collection ranges from six minutes to monthly, with six minute frequency starting in the 1980s.



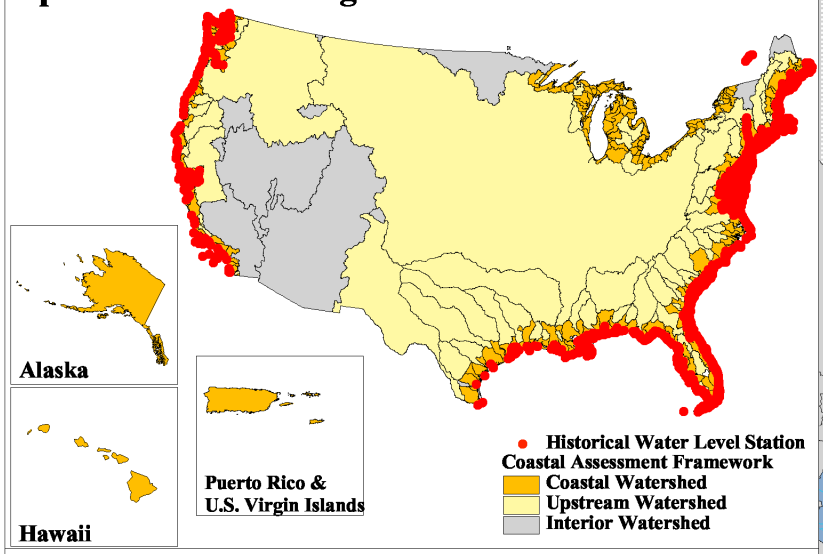
Regional Detail



NOS Environmental Monitoring Inventory **Center for Operational Oceanographic Products and Services (CO-OPS)**

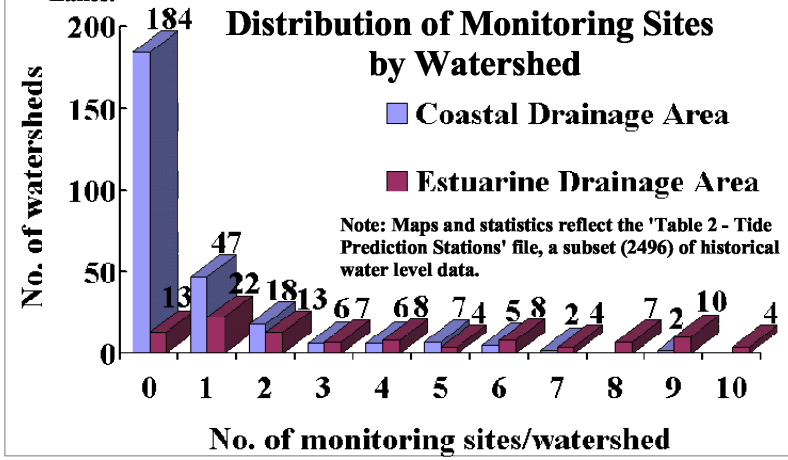
National Water Level Observation Network (NWLON) - Historical Water Level Stations

Spatial Extent of Program



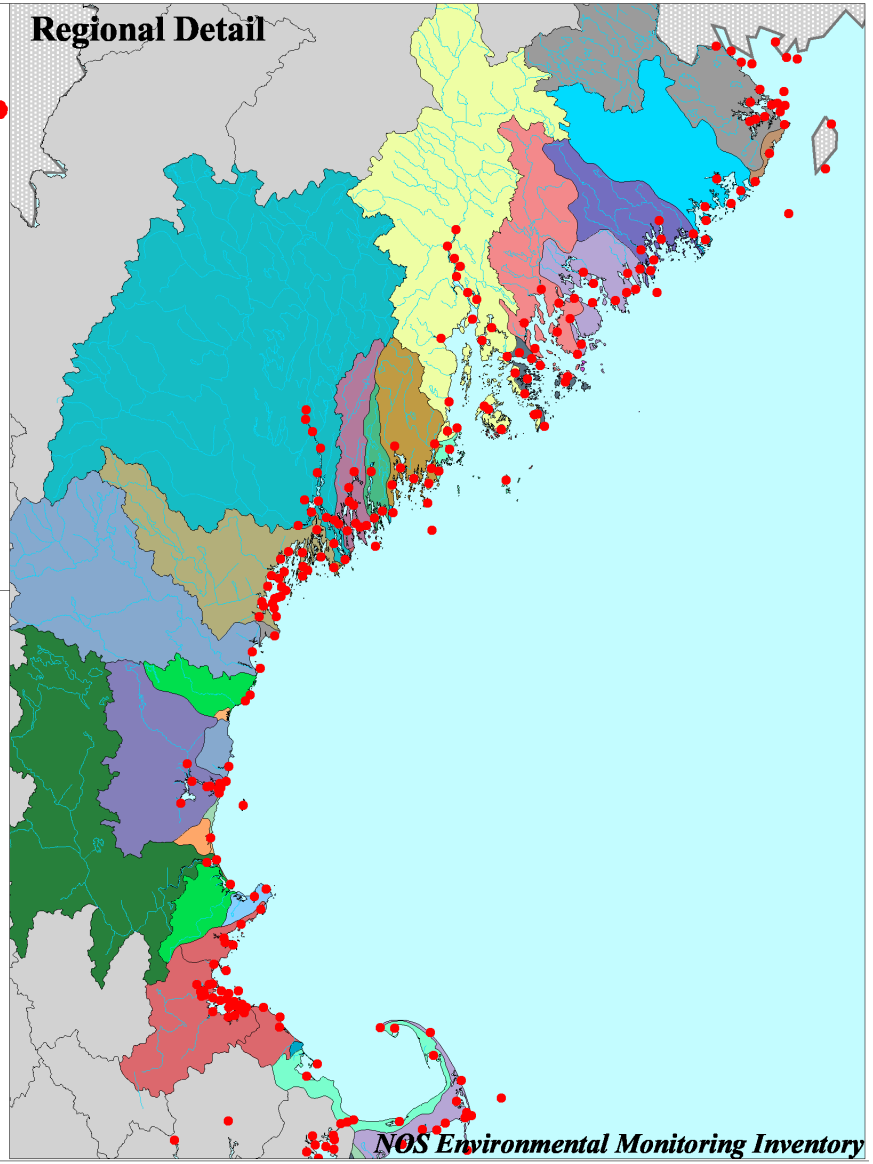
Program Facts

- Period of record starts in the 1850s.
- Frequency of sampling/collection is hourly, and monthly for the Great Lakes.



Note: Maps and statistics reflect the 'Table 2 - Tide Prediction Stations' file, a subset (2496) of historical water level data.

Regional Detail

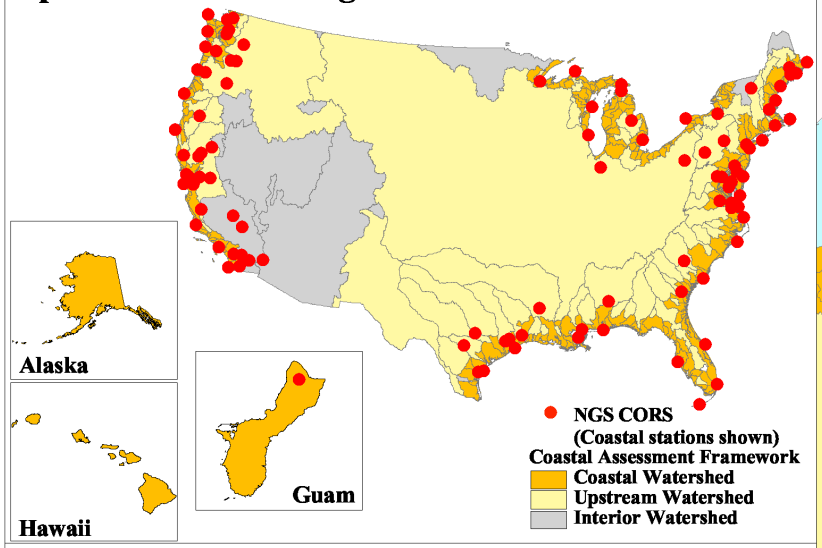


NOS Environmental Monitoring Inventory

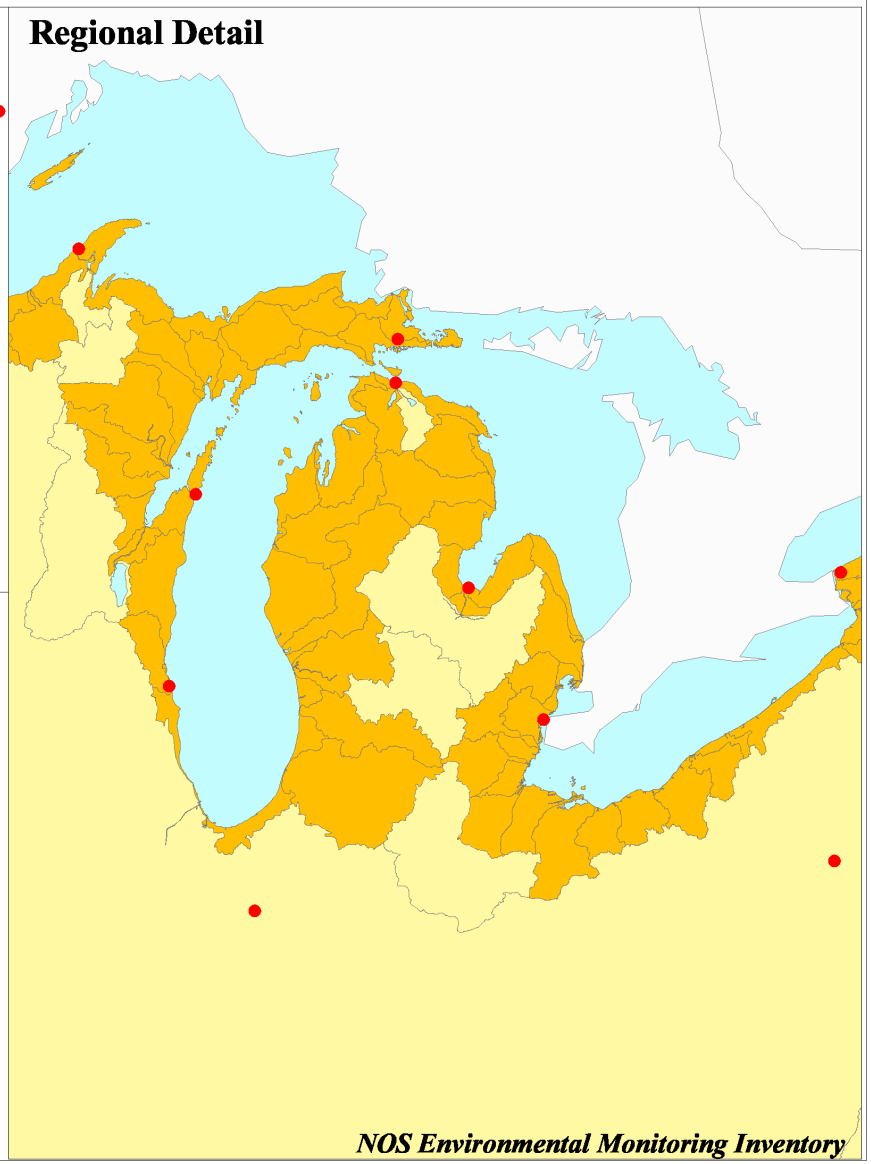
National Geodetic Survey (NGS)

Geodesy - Continuously Operating Reference Stations (CORS)

Spatial Extent of Program



Regional Detail



Program Facts

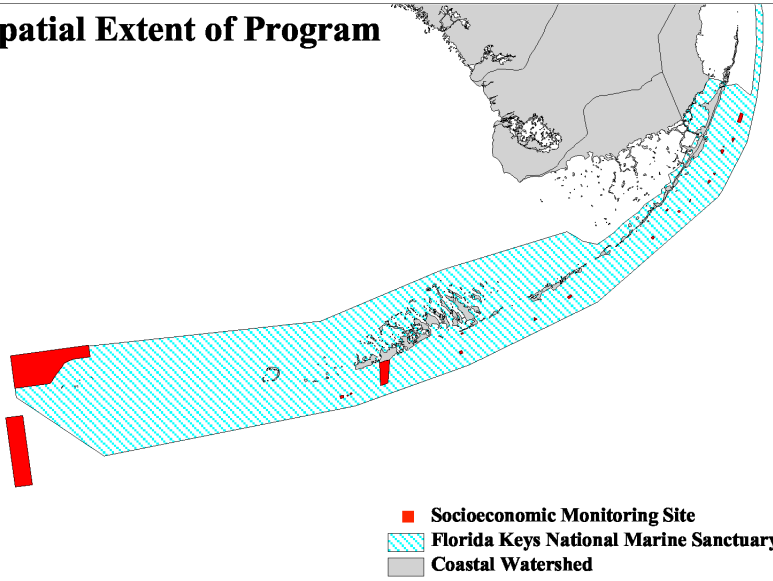
- The NGS CORS network provides Global Positioning System (GPS) carrier phase and code range measurements for 3-dimensional positioning activities.
- CORS may sample at rates of 5, 15, or 30 seconds.
- Surveyors, GIS/LIS professionals, engineers, scientists, and others use CORS information to position points where GPS data have been collected, with horizontal and vertical accuracies approaching a few centimeters relative to the National Spatial Reference System.
- New sites for the CORS system are growing at a rate of a few sites per month. There were 147 sites as of January 1999.

NOS Environmental Monitoring Inventory

Special Projects Office (SPO)

Socioeconomic Monitoring for Florida Keys National Marine Sanctuary

Spatial Extent of Program

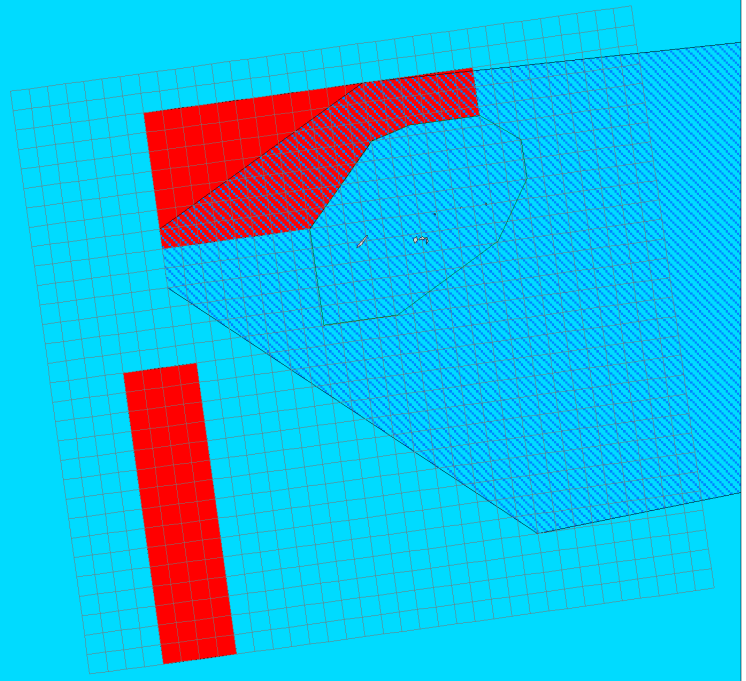


Program Facts

- Period of record starts in 1995 and is ongoing. Frequency of sampling/collection is every year for commercial fishing and recreational tourism, and every five years for recreational diving.

SURVEY AREA	AREA (sq nm)
Carysfort/South Carysfort Reef	1.00
The Elbow	0.30
Dry Rocks	0.05
Grecian Rocks	0.30
French Reef	0.10
Molassess Reef	0.30
Conch Reef	0.07
Cheeca Reek	0.05
Davis Reef	0.20
Hen and Chickens	0.20
Alligator Reef	0.20
Coffins Patch	0.40
Sombrero Reef	0.20
New Found Harbor Key	0.10
Looe Key	0.30
Eastern Dry Rocks	0.10
Rock Key	0.10
Sand Key	0.40
Sambos	9.00
Tortugas	151

Tortugas Ecological Reserve

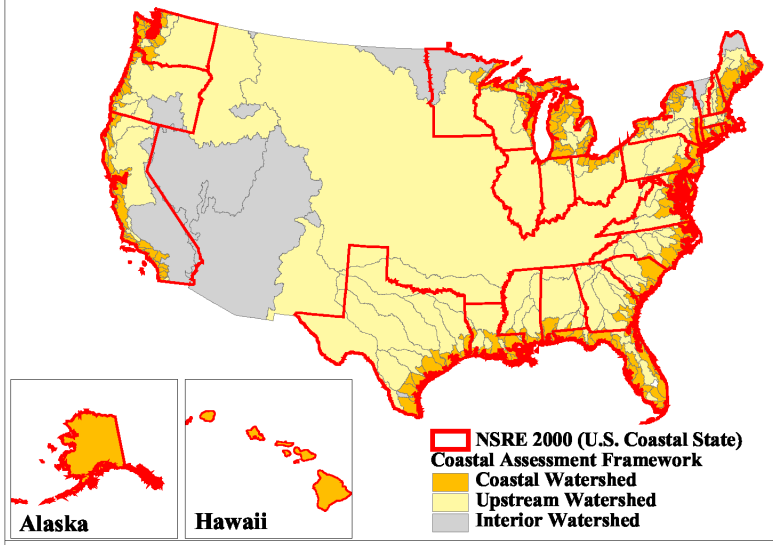


NOS Environmental Monitoring Inventory

Special Projects Office (SPO)

National Survey on Recreation and the Environment 2000 (NSRE 2000)

Spatial Extent of Program



Program Facts

- A nationwide cooperative effort involving a variety of public agencies and private organizations to establish benchmark data on recreational use and public attitudes towards natural resources and resource management.
- Last conducted in 1994, the NSRE is the 'next-generation' National Recreation Survey (NRS), the standard recreation survey of the United States since 1960.
- NSRE 2000 is the first survey to include a focus on recreation activities (19) in coastal and ocean areas.

Sponsoring Agencies or Organizations

The normally high costs of survey development are being shared by the following sponsoring agencies or organizations according to their own specific information needs:

Federal Agencies

U.S. Forest Service
National Oceanic and Atmospheric Administration
U.S. Environmental Protection Agency
U.S.D.A. Economic Research Service
U.S. Bureau of Land Management
National Park Service
Natural Resources Conservation Service

Association of State Outdoor Recreation Liaison Officers

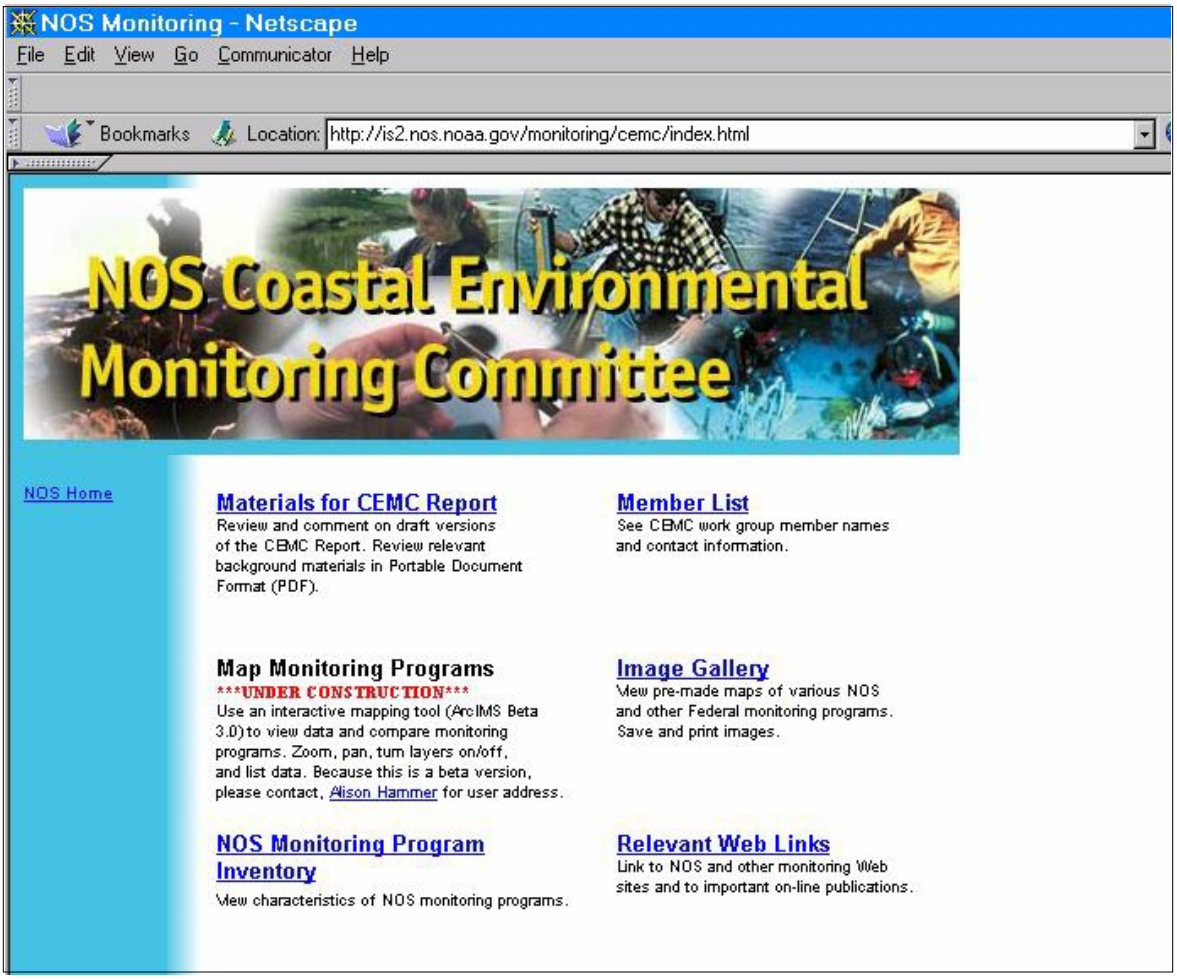
Private Organizations

Sporting Goods Manufacturers Association
The American Hikers Association
B.A.S.S., Inc.
American Motorcyclist Association
American Horse Council
Snow Sports Industries of America

Appendix IV
Summary of NOS Monitoring Survey Results

Appendix IV contains 3 pages of summary tables on the results of the NOS Monitoring Survey. However, they are tabloid size (8.5” x 22”) so they cannot be converted into a pdf document for you to download.

Please contact Alison Hammer@noaa.gov if you need a copy.



NOS' Special Projects Office has developed an internal Web site to support the efforts of the Coastal Environmental Monitoring Committee (CEMC). The site address is **http://is2.nos.noaa.gov/monitoring/cemc/**

The Web site includes six major sections:

1. ***Materials for CEMC Report:*** contains draft versions of the CEMC Report and other documents. Also contains relevant background materials in Portable Document Format (PDF).
2. ***Member List:*** Lists CEMC work group names and contact information.
3. ***Map Monitoring Programs:*** Provides an interactive mapping tool to view and compare monitoring programs.
4. ***Image Gallery:*** Displays pre-made maps of various NOS and other Federal monitoring programs.
5. ***NOS Monitoring Program Inventory:*** Describes characteristics of NOS monitoring programs obtained from an informal survey to NOS Program offices.
6. ***Relevant Web Links:*** Links to NOS and other monitoring Web sites including related legislative mandates/authorizations,